FS "MEASURING AND ADDRESSING POTENTIAL ADVERSE IMPACTS ON BIODIVERSITY FROM AGRICULTURAL SUBSIDIES"

2ND DELIVERABLE: IDENTIFICATION OF POTENTIAL NEGATIVE IMPACTS TO BIODIVERSITY AND ITS COMPONENTS BY AGRICULTURAL SUBSIDIES

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Table of Contents

Tables

Figures

Abbreviations / Acronyms

AHI	Affected Habitat Index
AMMAR	Agriculture Modernization, Market access and Resilience Project
BIOFIN	Biodiversity Finance Initiative
CBD	Convention on Biological Diversity
COP	Conference of Parties
CSI	Conservation Value Species Index
DIMMA	State Programme of Dairy Modernization and Market Access
EHS	Environmentally Harmful Subsidies
EU	European Union
FAO	UN Food and Agriculture Organization
GDP	Gross Domestic Product
GEL	Georgian Lari
IAPs	Invasive Alien Plants
IEEP	The Institute for European Environmental Policy
IMF	International Monetary Fund
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IRII	Impact Risk Increase Index
IUCN	International Union for Conservation of Nature
KBAs	Key Biodiversity Area(s)
M	Million
MA	Millenium Ecosystem Assessment
MEPA	Ministry of Environment Protection and Agriculture
NASP	National Agency of State Property
NBMS	National Biodiversity Monitoring System
NNLE	Non- entrepreneurial Non-commercial Legal Entity
OECD	Organisation for Economic Co-operation and Development
PAs	Protected Area(s)
PPP	Purchasing Power Parity
RDA	Rural Development Agency
SPABs	Special Protected Area(s) for Birds
SRCA	Scientific-research Centre of Agriculture
UK	United Kingdom
UNDP	UN Development Programme
UNEP	UN Environmental Programme
UNEP-WCMC	UNEP World Conservation Monitoring Centre
USD	United States of America Dollar

Executive Summary

This report is the second deliverable for the project "Measuring and Addressing Potential Adverse Impacts on Biodiversity from Agricultural Subsidies" based on analysis of existing / planned programs (past and future three years) managed by Rural Development Agency (RDA) of Ministry of Environment Protection and Agriculture (MEPA). It covers the following:

- Identification of potential negative impacts to biodiversity and its components per each program;
- Identification of shortcomings of the current programmatic support process setup;
- Assessment of the consequences of negative impacts in social-economic context;
- Identification of solutions to avoid/mitigate negative consequences from programs implementation.

Information on target agricultural subsidies was sourced from MEPA, RDA and Scientific-research Centre of Agriculture (SRCA) and through a series of online consultation meetings with their representatives. Additional data was acquired from public sources such web pages of governmental agencies and their publications. Location data (land parcel cadastre codes) were available for only four subsidies.

Twenty-one (21) agricultural subsidies have been identified to be implemented over the recent three years (2018 – 2021) and / or likely to be continued in the nearest future according to the MEPA 2022-2025 Mid-term Action Plan and Budget. All subsidies were screened using The Institute for European Environmental policy (IEEP) toolkit and subject to qualitative evaluation of potential negative impacts on biodiversity taking into consideration potential of the subsidized activities to result in impacts globally recognized as significant adverse impacts on biodiversity, geographic extent of subsidies and duration.

Eleven (11) agricultural subsidies have been excluded from the further analysis due to absence of significant negative impacts on biodiversity (9 subsidies) and absence of any data (2 subsidies). Hence, ten agricultural subsidies were analyzed to identify and quantify their potential adverse impacts on biodiversity.

Major challenges encountered were absence of specific location data for majority of the analyzed subsidies, lack of any guidance and / or data on quantification of biodiversity losses and ecosystem economic values / national natural capital accounts including estimation of monetary values of the above.

Different statistical methods were applied to estimate biodiversity losses on subsidized land and adjacent sensitive ecosystems based on a number of assumptions to overcome lack of specific data. For the purpose of monetary evaluation of biodiversity loss natural capital accounting system – widely used in EU and UK, which assesses ecosystem asset value based on services and functions, was used.

Analysis of documents related to target agricultural subsidies and information collected via personal communication in the course of a number of stakeholder meetings indicate the following shortcomings in the current programmatic support process:

1. Need for evaluation of potential negative impacts of agriculture on biodiversity is not prioritized in strategic documents adopted for agricultural sector
2. Subsidy planning stage
    a. Absence of high-level assessment of potential adverse impacts of the initiated subsidy on biodiversity
    b. Lack of synergy within the MEPA, viz.: between the departments of biodiversity and forestry, environmental assessment and RDA
3. No consideration of ecological or biodiversity-related criteria in subsidy application review process

4. Lack of digitized data on subsidy implementation monitoring collected by RDA and hence, non-usability of monitoring data for analysis of associated impacts
5. Absence of monitoring of subsidy implementation before 2021 making impossible analysis of success and shortcomings of past programs.

Main findings of qualitative and quantitative analysis of potential adverse impacts on biodiversity and socio-economic environment resultant from implementation of on-going and planned agricultural subsidies can be summarized as follows[1]:

- Total of 311.2 million USD was spent on 15 subsidy programs administered by the Rural Development Agency with average annual investment totalling 48.3 million USD. Preferential Agrocredit amounted to over 57% of the total funds allocated.
- In total, some 260,000 beneficiaries received an RDA subsidy. This is a fairly high number taking into consideration that estimated total number of workforce in rural areas is up to 611, 400, which means that four out of ten workforce has benefited from RDA subsidy.
- Over 62% of 260,000 beneficiaries (Agro-diesel support programme) received fixed one off assistance during a year, which is considered more a social subsidy than economic one. Up to 36% (i.e., 94,309 beneficiaries) benefited from Agroinsurance, Preferential Agrocredit and Plant the Future, which is regarded as more an economic subsidy than some kind of social benefit. These four RDA programs covered over 40% of the workforce in rural areas (mainly in the agricultural sector).
- Larger the subsidy funding, less the amount spent per beneficiary and vice versa. State Programme for Wheat Flour Subsidy pays the most per beneficiary (668,750 USD), which is 1,764 times higher than that of Agroinsurance that provides the lowest amount per beneficiary (379 USD) and 107 times higher than that of Preferential Agrocredit (6,212 USD per beneficiary). This means that some subsidies have socio-economic impact and some may have only economic impact without mass coverage.
- Agricultural subsidies with specific location data (four programs only: State Program Plant the Future, Georgian Tea Plantation Rehabilitation Program, Imereti Agrozone and The Programme Supporting Young Entrepreneurs in Rural Area - Young Entrepreneur (vineyards, animal husbandry, dairy farms)) - direct potential biodiversity loss has been found to be fairly substantial (loss of biodiversity associated with semi-natural grassland present on subsidized land parcels occurred on a total area of 2,753 ha). Indirect potential biodiversity loss (degradation of sensitive ecosystems at the nearest sensitive biodiversity receptor) has been estimated to occur on 1,114 ha of 14 different sensitive ecosystems. Estimated total monetary value of direct (loss of semi-natural grassland on subsidized land) and indirect (total annual cost of mechanical control and monitoring of invasive and expansive species and restoration of the nearest affected sensitive ecosystems involving propagation and re-introduction of ecosystem-specific plant species) biodiversity loss comprises 39.2M USD.
- Agricultural subsidies with no specific location data (six programs: Preferential Agrocredit, DIMMA, Co-financing Agricultural Mechanization, Supporting Agricultural Production, Co-financing of Processing and Storage Enterprises, AMMAR) - Statistical analysis based on extrapolation of the information from the four agricultural subsidies with specific location data shows that six subsidies will affect 28 different ecosystems present within the sensitive biodiversity receptors, which is substantial potential negative impact on biodiversity (up to 65% of all ecosystems of Georgia are potentially affected). Estimated (extrapolated) total monetary value of direct and indirect biodiversity loss resulting from implementation of these subsidies with no specific location data reaches 479.5M USD.

[1] Potential socio-economic impacts of the agricultural subsidies have been evaluated by the following key criteria: (1) Total investment in agricultural subsidies, (2) number of unique beneficiaries and (3) an amount spent per beneficiary.

- High proportion of animals recorded in Georgia[2] (up to 76% of all animals and 74% of species with protected status) is potentially present in areas affected by implemented agricultural subsidies.
- Expert evaluation shows that approximately 45% of Georgia's faunal species and 32% of protected animals may be exposed to substantial adverse impacts resulting from subsidized agricultural activities.
- Highest potential adverse impacts resulting from agricultural subsidies are predicted for insect pollinators and mammals.
- Preferential Agrocredit, Plant the Future, AMMAR, Supporting Agricultural production and DIMMA have been identified as the most biodiversity harmful programs based on review of available data and statistical analysis.

Taking into consideration review of available data on agricultural subsidies and results of analysis of potential biodiversity harmful impacts, a number of recommendations have been developed to avoid and / or mitigate negative consequences:

- Development of a database of on-going agricultural subsidies in order to streamline monitoring of consequences of on-going and planned agricultural subsidies
- Identification of agricultural subsidies with potential high adverse impacts on biodiversity during the subsidy planning and application review process
- Development of application assessment criteria to identify and stimulate projects minimizing adverse impacts on biodiversity
- Minimization of potential contamination of soil and water via incorporation of estimates on potential waste streams and volumes and volumes of fertilizers and pesticides intended for use in the subsidy application process
- Initiation of economic assessment of biodiversity loss due to agricultural subsidies on national level
- Raising ecological awareness of potential agricultural subsidy beneficiaries with regard to importance of biodiversity conservation (e.g., interdependence of biodiversity and agricultural productivity).

[2] Representatives of large animal groups: mammals, birds, reptiles, amphibians and insect pollinators

1 Consultations, Data Sources and Limitations

This report is the second deliverable for the project "Measuring and Addressing Potential Adverse Impacts on Biodiversity from Agricultural Subsidies" commissioned by UNDP / Biodiversity Finance Initiative (BIOFIN) in late November, 2021.

BIOFIN project was launched in Georgia in 2016. At the national level, the initiative supports implementation of the National Biodiversity Strategy and Action Plan (NBSAP), through assessing biodiversity expenditures and financial needs for implementation of NBSAP, as well as the development and implementation of the resource mobilization strategy. Current Phase of BIOFIN intends to implement four finance solutions. One of the four new finance solutions identified for BIOFIN second phase extension refers to "Measuring and addressing potential adverse impacts on biodiversity from agricultural subsidies". Agriculture / Rural development is a declared state priority and actively supported financially by state budget in Georgia. The NNLE (Non-entrepreneurial Legal Entity) Rural Development Agency (RDA) under the Ministry of Environmental Protection and Agriculture (MEPA) was established to support and manage different state-funded agricultural and rural development projects with the total budget of around 500 M GEL (around USD 200 M) for 2018-2020 and 200 M GEL (USD 65 M) for 2021.

This report provides an analysis of existing / planned programs (past and future three years) managed by RDA and details the following:

- Identification of potential negative impacts to biodiversity and its components per each program;
- Identification of shortcomings of the current programmatic support process setup;
- Assessment of the consequences of negative impacts in social-economic context;
- Identification of solutions to avoid/mitigate negative consequences from programs implementation.

Information on agricultural subsidies implemented in 2018 – 2021 and planned for 2022 – 2025 was sourced from web-pages of MEPA and RDA and through a series of online consultation meetings with Mariam Gelashvili, Head of Project Development Department, RDA and Severian Machaidze, Head of the Unit for Project Support and Communication with donors. On-line meetings were held on 02/11/2021 and 12/11/2021. At the same time, additional information was obtained through official correspondence by the Biodiversity and Forestry Department of MEPA. In response to Dzelkva / Ecolution team requests, RDA provided the following information:

1. Brief description of RDA funding issuance
2. Instruction on RDA project / program beneficiary monitoring
3. PowerPoint Presentation on RDA administered project
4. Statistics of RDA administered projects by regions and years by 30/09/2021
5. RDA administered project goals and summary statistics by 30/09/2021
6. Land cadastre data of State Program Plant The Future beneficiaries' land parcels by 11/11/2021
7. Legal status of RDA project / program beneficiaries by 30/09/2021
8. Status of State Program Plant The Future by 30/09/2021
9. Order of Minister of Environment Protection and Agriculture No. 2-999, dated 30/06/2021 on Approval of MEPA 2022-2025 Mid-term Action Plan with two annexes (MEPA 2022-2025 Mid-term Action Plan and Budget).

Another consultation meeting was held with Nana Goginashvili, Head of Agroforestry Research Division, Scientific-research Centre of Agriculture (SRCA) on 29/11/2021. She provided electronic brochures on SRCA recommended agricultural technologies to cultivate different crops and best practices in agricultural production.
Subsidized land parcel data were sourced for two more programs - Tea Plantation Rehabilitation State Program "Georgian Tea" and Imereti Agrozone from the web sites of

National Agency of State Property (NASP) (http://nasp.gov.ge/page/chai/list.php?type=5&of=0) and Imereti Agrozone (https://www.iaz.ge/).

In addition, land parcel cadastre code data on two more programs – "Young Entrepreneur" and "Co-financing of Processing and Storage Enterprises" were provided by RDA on 11/03/2022 following a 28/02/2022 consultation meeting with Ilia Tamarashvili, RDA Director and Nikoloz Kavtaradze, RDA Deputy Director. Data released on the State Programme of Diary Modernization and Market Access (DIMMA) lacks land parcel data.

Location data on land plots subsidized by other RDA-administered programs were not available for analysis.

2 Agricultural Subsidies and Biodiversity Loss

Impact of public subsidies on the environment has been drawing increasing attention over the last decades, in particular within the Organization for Economic Co-operation and Development (OECD) and the European Union (EU). Focus on biodiversity is more recent, viz.: in 2010, the tenth meeting of the Conference of the Parties (COP 10) of the Convention on Biological Diversity (CBD) adopted a decision on Incentive Measures[3], which encourages Parties to adopt a range of policy measures and regulations designed to promote positive incentives and phase out perverse incentives, as well as to account for the value of biodiversity and ecosystem services in decision making. The COP 10 also adopted a strategic plan for 2011-2020 and its Aichi Biodiversity Targets. One of the targets under the Strategic Plan aims at reforming, eliminating or reducing public incentives with significant negative impacts on biodiversity and introducing positive incentives for conservation and sustainable use of biodiversity by 2020. The European Community strategy supporting biodiversity has been recommending such elimination since 1998[4].

Research published over the last two decades agrees on the accelerating pace of biodiversity loss and on the existence of five major pressures that are responsible for it:

- Destruction and qualitative deterioration of habitats owing to fragmentation, changes in land use, land development, simplification and intensification of farming practices
- Overexploitation of renewable natural resources (fishery resources, water, soil and forests)
- Pollution (nitrates, pesticides, heat pollution and drug residues)
- Climate change, which exerts an influence on all balances but is the object of many other forms of actions and policies
- Invasive species.

It is a challenge to establish a ranking of these causes, even if the main impact appears to be the result of land development and habitat deterioration. The effects tend to be mutually reinforcing. It is also evident that although subsidy mechanisms can apply in an undifferentiated manner to the entire country, their effects are often distinctly different depending on the environments concerned. In addition, public subsidies may frequently target areas, which are particularly rich and / or fragile in terms of biodiversity.

One of key findings of the Global Assessment on Biodiversity and Ecosystem Services (The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services – IPBES[5], 2020) is that for terrestrial and freshwater ecosystems, land use change has had the largest relative negative impact on nature since 1970. This assessment also identifies an agricultural

[3] CBD (2010) The Conference of the Parties Decision X/44: Incentive Measures

[4] Public incentives that harm biodiversity, 2012. Centre for Strategic Analysis

[5] IPBES was established in 2021 by 94 Governments to strengthen the science-policy interface for biodiversity and ecosystem services for the conservation and sustainable use of biodiversity, long-term human well-being and sustainable development

sector as the most widespread form of land use change, with over one third of the terrestrial land surface being used for cropping or animal husbandry.

Support to agricultural producers currently accounts for almost USD 540 billion a year globally, which comprises 15% of total agricultural production value according to the recent FAO, UNDP and UNEP assessment (A Multi-Billion-Dollar Opportunity - Repurposing Agricultural Support to Transform Food Systems, 2021. FAO, UNDP &UNEP). This report predicts that under a continuation of current trends, support to agricultural producers could reach almost USD 1.8 trillion in 2030.

FAO, UNDP &UNEP assessment states that approximately USD 294 billion of total support to agricultural producers was provided in the form of price incentives and around USD 245 billion as fiscal subsidies to farmers, the majority (70 per cent) being tied to the production of a specific commodity. Only USD 110 billion was used to fund transfers to the agriculture sector collectively, in the form of general services or public goods.

The above global assessment concludes that agricultural subsidies can lead to substantial negative environmental outcomes (e.g. through overuse of agrochemicals and natural resources, and the promotion of monoculture) and nutritional outcomes (e.g. by disproportionately fostering production of staples versus fruits and vegetables). These subsidies also drain public resources that could instead be invested in areas where returns are higher and benefits more long lasting, thus hindering efficient and more sustainable use of often-limited public funds.

Large-scale agricultural subsidies aimed at intensification and / or expansion of agricultural production was initiated in 2013. All agricultural subsidies are administered by the RDA – structural unit of MEPA. Since 2013 RDA has provided funding for over twenty subsidy programs, which are administered under the name Unified Agro-project. Since 2013 the Unified Agro-project has spent some 1.57 bln GEL (595 M USD).

3 Methodological Framework for Identification of Subsidies Harmful to Biodiversity

3.1 Qualitative Evaluation of Potential Adverse Impacts of Agricultural Subsidies on Biodiversity

The Institute for European Environmental Policy (IEEP) has developed a toolkit to identify and reform incentives harmful to biodiversity[6], which is structured around a number of phases as illustrated in Figure 1.

[6] Toolkit to identify and reform incentives harmful to biodiversity, Institute for European Environmental Policy, 2017

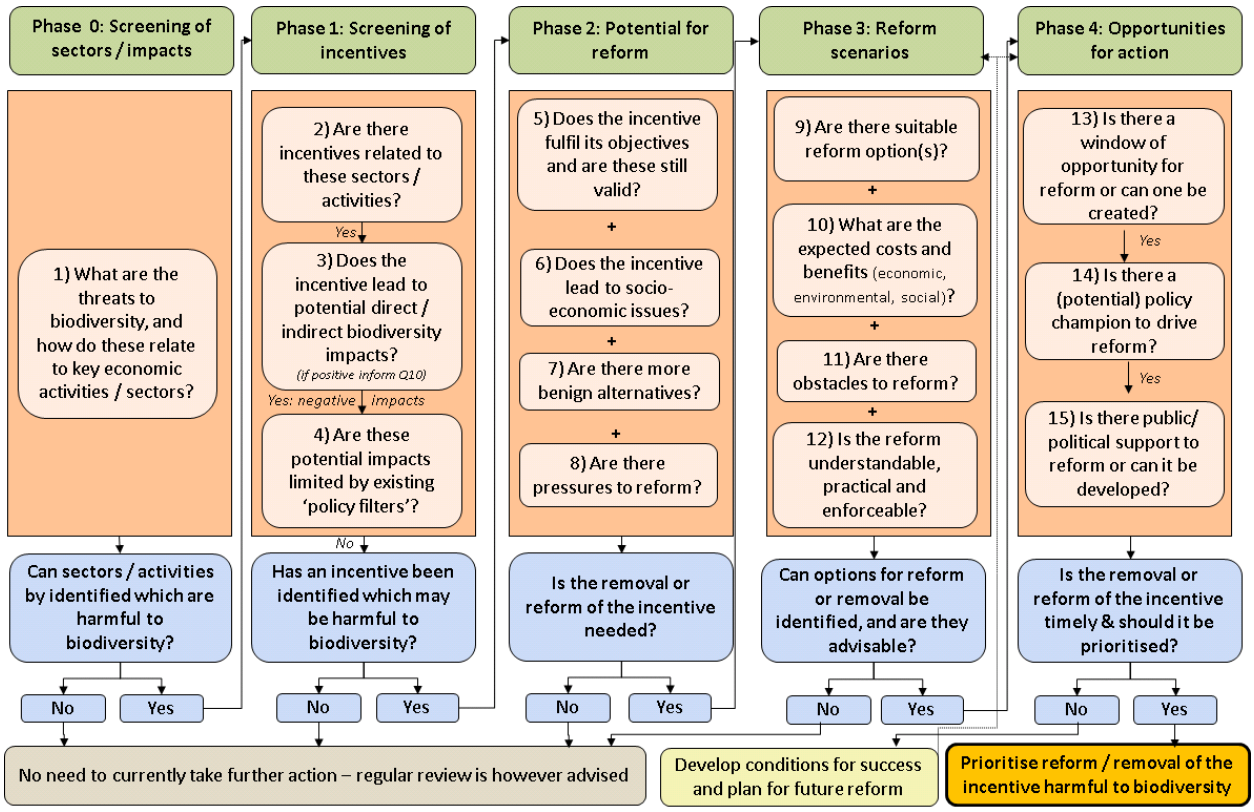


Figure 1. Biodiversity Harmful Subsidy Identification and Reform Toolkit

The IEEP has also developed a methodological framework to identify and evaluate subsidies harmful for biodiversity[7], which is comprised of the following three major stages:

1. Inventory of potential biodiversity harmful subsidies, which is equivalent to Phase 1 "Screening of Incentives" – Is there a Subsidy? (Fig. 1)
2. Demonstration of the cause / effect link between public aid and the state of biodiversity, which is equivalent to Phase 1 "Screening of Incentives" – Does the subsidy lead to potential direct / indirect biodiversity impacts?
3. Reconfiguration of public subsidies identified as harmful to biodiversity corresponding to Phases 2 "Potential for Reform", 3 "Reform Scenarios" and 4 "Opportunities for Action".

Incentives / subsidies are potentially harmful to biodiversity when they directly or indirectly influence at least one of the major causes of loss of biodiversity such as the destruction / deterioration of habitats, the over-exploitation of natural resources, the pollution of environments, the dissemination of invasive alien species and climate change[8].

The above methodological framework has been applied in order to identify and qualitatively evaluate agricultural subsidies administered by RDA.

3.2 Quantification of Potential Adverse Impacts of Agricultural Subsidies on Biodiversity

RDA provided different data sets on agricultural subsidies, specifically data on locations of subsidized land parcels were made available for only the following programs:

1. State Program Plant the Future
2. Co-financing of Processing and Storage Enterprises

[7] IEEP (2009), Environmentally Harmful Subsidies (EHS): Identification and Assessment

[8] Public incentives Harmful to Biodiversity, 2015. Centre for Strategic Analysis

3. Georgian Tea Plantation Rehabilitation Program
4. The Programme Supporting Young Entrepreneurs in Rural Area - Young Entrepreneur
5. Imereti Agrozone.

Taking into consideration the absence of specific location data for other subsidies, two approaches have been developed to evaluate levels of associated potential adverse impacts.

3.2.1 Subsidies with Specific Location Data

Quantification of potential impacts of these subsidies on biodiversity is based on (1) direct loss of biodiversity potentially associated with the subsidized land parcels and (2) potential adverse impacts of agricultural activities carried out on subsidized land parcels on the nearest sensitive biodiversity receptors. Sensitive biodiversity receptors considered in this analysis are:

1. Protected Areas (PAs)
2. Emerald Network Sites
3. Georgian State Forest Fund
4. Key biodiversity areas (KBAs)
5. Ramsar sites
6. Important Bird Areas (IBAs)
7. Special protected areas for birds (SPABs)
8. Migrant bird rest areas.

Ecosystems / habitats likely to be present at each sensitive biodiversity receptor have been identified based on Vegetation Map of Georgia[9].

Monetary quantification of loss of biodiversity directly on the subsidized land parcels is based on the assumption that such areas support different semi-natural grassland communities taking into account that key objective of all administered subsidies is to facilitate cultivation of formerly / temporarily abandoned agricultural land. However, no monetary valuation of ecosystems has been conducted in Georgia to date. Therefore, estimation of biodiversity loss on subsidized areas is based on natural capital accounting system – widely used in EU and UK, which assesses ecosystem asset value based on services and functions (https://www.daba.gov.lv/en/habitat-conservation-and-management-guidelines?utm_source=https%3A%2F%2Fwww.google.com%2F; https://www.ons.gov.uk/economy/environmentalaccounts/bulletins/seminaturalhabitatnaturalcapitalaccountsuk/2021/previous/v1).

Natural capital refers to “the stock of renewable and non-renewable resources (e.g. plants, animals, air, water, soils, minerals) that combine to yield a flow of benefits to people” (Natural Capital Coalition). One of the most important and recent studies on natural capital valuation is by the IPBES (Global Assessment on Biodiversity and Ecosystem Services). This assessment warned of deteriorating state of natural capital estimating that between USD 235 to 557 billion in crop value is at risk due to insufficient pollination, and around 25% of assessed species are at risk of extinction within the next decade (IPBES 2019[10]).

Biodiversity, healthy ecosystems, and the survival of species all have intrinsic value, but their instrumental value to humans is provided through the products and services obtained from ecosystems and are best described using the term “ecosystem services”. The concept of ecosystem services was brought into widespread use by the Millennium Ecosystem

[9] U. Bohn, N. Zazanashvili, George Nakhutsrishvili, 2007. The Map of the Natural Vegetation of Europe and Its Application in the Caucasus Ecoregion. Bulletin of the Georgian national Academy of Sciences, 175.

[10] IPBES (2019): Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. E. S. Brondizio, J. Settele, S. Díaz, and H. T. Ngo (editors). IPBES secretariat, Bonn, Germany. 1148 pages. https://doi.org/10.5281/zenodo.3831673

Assessment (MA) - a global initiative set up in 1999 to assess how ecosystem change would affect human well-being. Ecosystem services are functions of an ecosystem that directly or indirectly benefit human wellbeing (Daly and Farley, 2004[11]; Voldoire and Royer 2004[12]). Specifically, ecosystem services include both portions of the natural capital itself, such as timber or fish, that are harvested from ecosystems as well as the flows of services, such as watershed protection or climate regulation, that can be derived from and rely on stocks of natural capital. The MA divided ecosystem services into four categories:

- Supporting services. These are services, such as nutrient cycling and soil formation, which are needed for the production of all other services.
- Provisioning services. Products obtained from ecosystems, such as food or timber.
- Regulating services. The benefits obtained from the regulation of ecosystems, including services such as purification of water, flood control, or regulation of the climate via carbon sequestration.
- Cultural services. The benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences.

Figure 2 below displays the concept of natural capital, ecosystem capital and service flows.

Biologically diverse ecosystems provide a greater flow of ecosystem services than non-diverse systems (Hooper et al. 2005[13], Flombaum and Sala 2008[14]). Hence, support to biologically diverse ecosystems – or alternatively support to the biodiversity of a stock of natural capital – ensures the reliable provision of ecosystem services from the stocks of natural capital. This, by extension, ensures that the stock of natural capital and the services they provide are more resilient to shocks and changing physical environments – a necessity in the face of widespread impacts of climate change.

[11] Daly, Herman E., and Joshua C. Farley. 2004. Ecological Economics: Principles and Applications.

[12] Voldoire, A. and Royer, J.F. (2004) Tropical Deforestation and Climate Variability. Climate Dynamics, 22. https://doi.org/10.1007/s00382-004-0423-z

[13] D. U. Hooper,F. S. Chapin III,J. J. Ewel,A. Hector,P. Inchausti,S. Lavorel,J. H. Lawton,D. M. Lodge,M. Loreau,S. Naeem,B. Schmid,H. Setälä,A. J. Symstad,J. Vandermeer,D. A. Wardle. 2005. Effects of Biodiversity on Ecosystem Functioning: A Consensus of Current Knowledge

[14] Flombaum P, Sala OE. Higher effect of plant species diversity on productivity in natural than artificial ecosystems. Proceedings of the National Academy of Sciences of the United States of America. 2008 Apr;105(16):6087-6090. DOI: 10.1073/pnas.0704801105. PMID: 18427124; PMCID: PMC2329694.

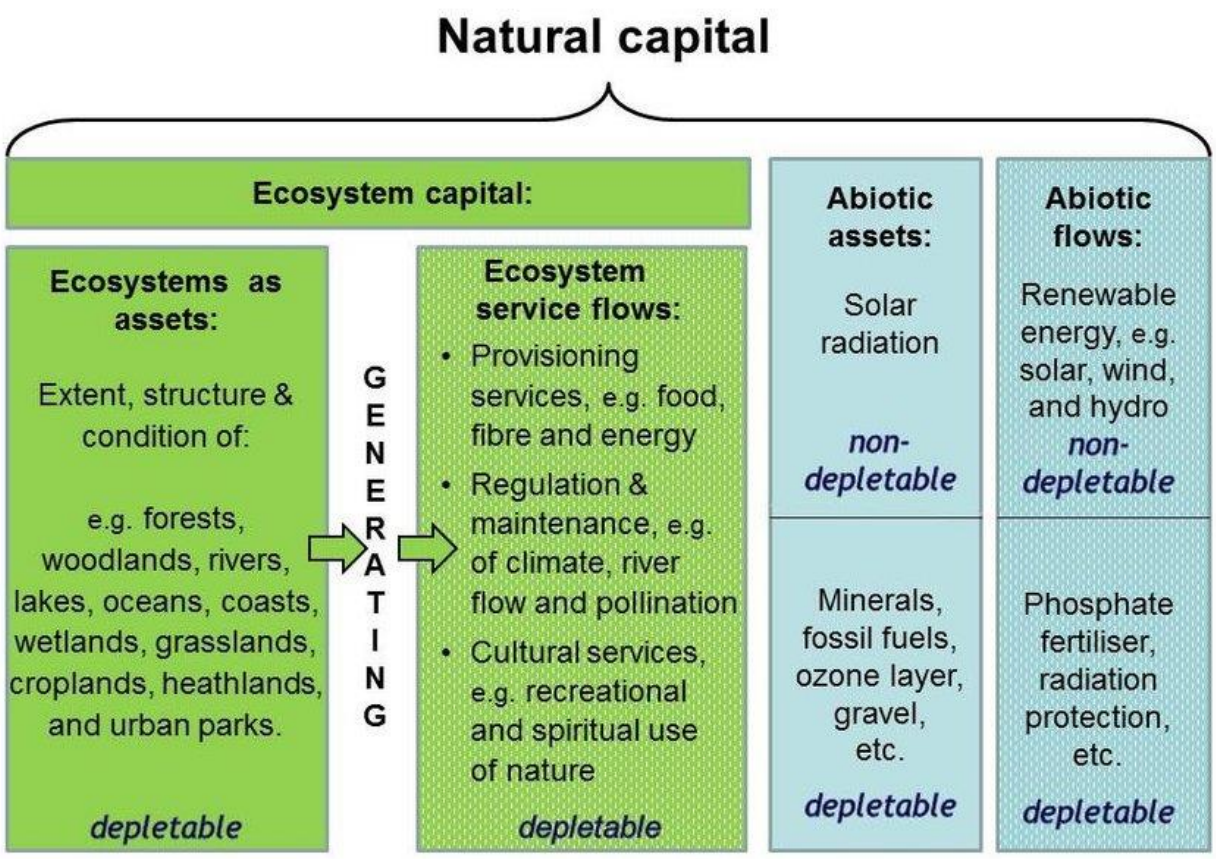


Figure 2. Natural Capital Components

Annual semi-natural ecosystem asset value for the temperate zone of Eurasia[15] (Refer to Section 6.2) has been adjusted for Georgia based on General price Levels (Table 19, Section 6.2: Monetary Value of Biodiversity Loss Associated with Subsidized Land Parcels). The resultant value has been assumed to represent an indication of monetary value of biodiversity loss per one hectare of semi-natural grassland in subsidized plots. Assumptions made in order to estimate acreage of semi-natural grassland on subsidized land parcels are as follows:

- State Program Plant the Future, Imereti Agrozone, The Programme Supporting Young Entrepreneurs in Rural Area - Young Entrepreneur (vineyards, animal husbandry, dairy farms) – it is assumed that a third of subsidized land parcel supported secondary grassland prior to subsidy
- Georgian Tea Plantation Rehabilitation Program – it is assumed that fifth of subsidized land parcel supported secondary grassland prior to subsidy.

Approach applied to monetary quantification of potential biodiversity impacts at the nearest sensitive biodiversity receptors resultant from agricultural activities carried out on subsidized land parcels is described below.

Taking into account that the prime objective of all administered subsidies is to facilitate cultivation of formerly / temporarily abandoned agricultural land, the subsidized agricultural activities will directly affect semi-natural vegetation established on respective land parcels. Likewise, animals associated with agricultural habitats and nearest sensitive ecosystems within biodiversity receptors will be impacted. The potential impact zone was assumed a 0-5km zone from the edge of nearest sensitive biodiversity receptors taking into consideration mobility of different animal species.

[15] Semi-Natural Habitat Natural Capital Accounts, UK: 2021

One of globally acknowledged key threats to biodiversity associated with agricultural expansion and / or intensification is increased risk of inadvertent introduction / expansion of invasive alien plant species (IAPs) and expansive species[16] into adjacent undisturbed ecosystems. For the purpose of monetary quantification of resultant biodiversity loss, costs of mechanical control of populations of such species were assumed as indication of biodiversity degradation recovery costs. It should be taken into consideration that IAPs and expansive plants suppress natural regeneration in woodland and scrub habitat and have very low impact on canopy layer (established trees) while they may substantially transform the floristic composition and structure of open habitats such as different modifications of grassland, wetland, etc. Therefore, monetary value of biodiversity degradation recovery in grassland and wetland also includes costs associated with native plant seed collection, propagation, seedling establishment and re-introduction into affected habitats to restore original structure and floristic composition.

It is assumed that agricultural activities on subsidized land parcels located within 0-1 km zone from sensitive biodiversity receptors may serve as source for penetration of invasive and expansive species. A 20 m. wide peripheral zone of sensitive biodiversity receptors closest to the subsidized land parcels are most susceptible to biological (plant) invasions as indicated by findings of technical reports on monitoring of invasive alien species in Georgia (Project: "Elaboration of the Indicators S3 "*Population sizes of selected species"* (Part 1: Flora) and P9 "*Number and distribution of invasive species" - (50 worst alien plant species in Georgia)*, 2013-2014; Monitoring of Short-listed Invasive Alien Plant Species in Selected Protected Areas of Georgia, 2021, etc.). Ecosystems / habitats likely to be present in 20m wide peripheral zone of each potentially affected sensitive biodiversity receptor have been identified based on Vegetation Map of Georgia.

As noted above, it has been assumed that agricultural activities carried out at subsidized land parcels located within 0 – 5km zone from the border of the nearest sensitive biodiversity receptor are likely to affect ecosystem and a number of animals species. Key agricultural activities with substantial negative impacts on fauna are as follows:

- Land cultivation including any manipulation of the ground surface such as different types of conventional tillage, watering, raking, etc.
- Application of pesticides[17]
- Application of fertilizers
- Contamination of soil with hydrocarbons and other chemicals
- Crop maintenance activities such as pruning, harvesting, mulching, etc.

Animal species by large groups (mammals, birds, reptiles, amphibians, insect pollinators) associated with agricultural habitats, open landscapes and ecosystems present in sensitive biodiversity receptors were identified including species with conservation status (listed in the IUCN Red List and Georgian Red List). The next stage involved identification of species, which may potentially be lost or temporarily displaced or affected via decrease in abundance of prey species due to implementation of agricultural activities given above. This also included identification of potentially impacted conservation value species. Potential impacts on fauna have not been quantified in monetary terms assuming that loss of species has been taken into account in estimation of biodiversity loss directly on the subsidized land parcels and ecosystem degradation at the nearest sensitive biodiversity receptors due to subsidized agricultural activities. However, potential impacts on fauna and large animal groups have been statistically analyzed.

[16] Species that increase their distribution and colonize new habitats in a geographical area where they are native, e.g., weeds and species forming mono-dominant communities usually characterized by effective dispersal mechanism

[17] Pesticides include herbicides for destroying weeds and other unwanted vegetation, insecticides for controlling a wide variety of insects, fungicides used to prevent the growth of molds and mildew, disinfectants for preventing the spread of bacteria, and compounds used to control mice and rats

Two indices have been applied in statistical analysis of potential impacts on fauna, viz.: (1) Conservation value Species Index (CSI, %) and (2) Impact Risk Increase Index (IRII, %).

CSI is calculated as the per cent share of conservation value species in total number of species of a given animal group:

$$100*S_C/S_G\%$$

where S_C is the number of conservation value species and SG is the total number of species in the given animal group. This index reflects baseline state prior to subsidy implementation.

IRII is calculated as the per cent of impact risk increase after the programme is implemented:

$$100*(S_n*2 + S_c*4)/S_G\%$$

where S_n is number of impacted species with no conservation value, S_c is number of impacted conservation value species and S_G is total number of species in the given large animal group. This index is designed to show magnitude of potential negative impacts on different animal groups.

3.2.2 Subsidies with No Specific Location Data

Agricultural subsidies with potential adverse impacts on biodiversity for which geographic information was not available have been subject to statistical analysis to identify scale of potential biodiversity loss.

Statistical analysis was based on calculation of ratio between the following variables by subsidies:

- Number of agreements[18]
- Potential impact scale (low, medium, high) based on expert assessment of potential harmful effects of each subsidy on biodiversity (Table 1, Section 4.1: Identification of Agricultural Subsidies with Potential Harmful Impacts on Biodiversity& Table 16, Section 6.1: Social-economic Overview of Agricultural Subsidies)
- Total acreage of sensitive biodiversity receptors by regions where subsidies were implemented.

Two indices have been applied in statistical analysis: (1) Affected Habitat Index and (2) Subsidy Impact Index.

Affected Habitat Index ranks habitats from most to least affected throughout the subsidy implementation area. This index is calculated as follows:

*Affected Habitat Index = Impact coefficient*Intensity coefficient*habitat area*

where

Impact coefficient = expert assessment score 1 to 7 (Table 6, Section 6: Social-economic Assessment of Biodiversity Impacts of Agricultural Subsidies);
Intensity coefficient = *lg* (Number of agreements);
habitat area - is total area (ha) occupied by the given habitat in all sensitive biodiversity receptors in all regions where subsidies are implemented.

Intensity coefficient is calculated from number of agreements per subsidy to reflect dependence of potential impacts on intensity of agricultural activities (assumption being that higher the number of agreements, higher agricultural activity intensity, hence, potential impacts on

[18] Number of agreements reflect magnitude of potential impacts more accurately than number of beneficiaries as the review of the RDA data showed that some beneficiaries were awarded two or more subsidies

ecosystems will be proportionally higher). Taking into consideration high variability of agreement numbers across subsidies, this coefficient was calculated as a logarithm to reduce statistical noise.

Total Impact index per subsidy program was calculated using the same Impact and Intensity Coefficients multiplied by total area of all sensitive habitats potentially affected by each subsidy:

*Total Impact Index = Impact coefficient*Intensity coefficient*Total Habitat Area*

where

Impact coefficient as given above
I*ntensity coefficient* as given above
Total Habitat Area = total area (ha) of all affected habitats per each subsidy.

The above indices were used to rank the habitats from the most to least affected and the subsidies from the most to the least harmful.

4 Evaluation of Potential Adverse Impacts of Agricultural Subsidies on Biodiversity

4.1 Identification of Agricultural Subsidies with Potential Harmful Impacts on Biodiversity

The Report on Detailed Analysis of Existing and Planned RDA Programs identified agricultural subsidies implemented over the recent three years (2018 – 2021) and those likely to be continued in future (2022 – 2025). These subsidies are as follows:

1. Preferential Agrocredit – 2013 – 2021 / planned to continue in 2022 - 2025
2. Agroinsurance – 2014 -2021 / planned to continue in 2022 – 2025
3. State Program Plant the Future – 2015 – 2021 / planned to continue in 2022 – 2025
4. Georgian Tea Plantation Rehabilitation Program – 2016 – 2021 / planned to continue in 2022 – 2025
5. Co-financing of Processing and Storage Enterprises – 2014 – 2021 / planned to continue in 2022 – 2025
6. Farm / Farmers' Registration Project - 2018 – 2021 / planned to continue in 2022 – 2025
7. State Programme for Technical Assistance – 2016 – 2021 / planned to continue in 2022 – 2025
8. Programs Supporting Development of Agricultural Cooperatives – 2019 – 2021 / planned to continue in 2022 – 2025
9. Dairy Modernization and Market Access State Program (DIMMA) – 2020 – 2025 / planned to continue in 2022 – 2025
10. State Programme of Co-financing Agricultural Mechanization (Harvesting Equipment / Machinery Co-funding Project) – 2019 - 31/03/2021 / planned to continue in 2022 – 2025
11. Imereti Agrozone – 2020 – 2025 / planned to continue in 2022 – 2025
12. Agriculture Modernization, Market Access and Resilience Project (AMMAR) – 2016 – 2021 / planned to continue in 2022 – 2025
13. Green Grants Programme – 2021. This program is temporarily suspended
14. Agricultural Land Owner Support Program – 2020 – 31/03/2021 (has ended)
15. Programme Supporting Young Entrepreneurs in Rural Area - "Young Entrepreneur" - 2018 – 2021
16. Agro-diesel Support Program – 2020 – 2021 (has ended)
17. State Programme for Supporting Agricultural Production - 2020 -31/12/2020 (has ended)
18. Improving Rural Development in Georgia - 2020 – 2021 (suspended temporarily)
19. One-off Assistance for Hail-induced Damage in Kakheti Region - 2021 – 31/12/2021
20. Industrial Apple Sale Promotion Program - 2021 – 15/12/2021
21. State Programme for Wheat Flour Subsidy – 2020 - 2021.

Majority of the identified agricultural subsidies largely aim at agricultural intensification and / or expansion. According to IEEP toolkit, agricultural activities which stimulate intensification and / or expand production can lead to the following significant adverse impacts on biodiversity:

- Loss of non-crop habitat eventually resulting in disrupted food chains and declines in species
- Loss of non-target species, including pollinators, due to direct and indirect effects of pesticides
- Reduced habitat diversity due to consolidation of holdings, removal of patches of non-farmed habitats and boundary features, and greater regional specialisation
- Loss of biodiversity-rich extensive farmlands (e.g. due to increased fertiliser use or increased grazing)
- Destruction of important habitats from land-use change
- Hydrological changes to habitats from drainage or irrigation (e.g. leading to wetland loss and reductions in groundwater levels)
- Eutrophication of freshwater, marine and terrestrial ecosystems (e.g. from fertilizers and nutrient rich run-off)
- Eutrophication of terrestrial ecosystems from deposition of airborne nutrients, particularly ammonia, from intensive livestock systems; and
- Soil degradation and erosion from routine cultivation.

Qualitative evaluation of all agricultural subsidies identified in the report on Detailed Analysis of Existing and Planned RDA Programs was conducted taking into consideration potential of the subsidized activities to result in impacts globally recognized as significant adverse impacts on biodiversity, geographic extent of subsidies and duration.

Several subsidies such as Agroinsurance, Farm / Farmers' Registration Project, State Programme for Technical Assistance, Program Supporting Development of Agricultural Cooperatives, Green Grants Programme, One-off Assistance for Hail-induced Damage in Kakheti Region, Industrial Apple Sale Promotion Program and State Programme for Wheat Flour Subsidy (8 subsidies in total) are not likely to have significant negative impacts on biodiversity as they do not provide funding for any agricultural or other activity affecting ecosystems or its key components. Consequently, they are excluded from impact analysis process.

Table 1 below provides a summary of potential impact levels on biodiversity associated with subsidy activities while description of impacts is given in Sections 4.1.1 – 4.1.13.

Table 1. Potential Adverse Impact Levels on Biodiversity by Subsidies

N	Project	Years	Project Component / Activities affecting biodiversity	Adverse Impact Level on Biodiversity (Low, Medium, High)	
				Ecosystem	Species
1	Preferential Agrocredit	2013 - 2021	• Tillage including inter-row tillage • Application of fertilizers • Application of pesticides • Primary Agricultural Facilities / Farms • processing and infrastructural facilities	Medium to High	Medium to High
2	Agroinsurance	2014 - 2021	• Co-funding insurance against hail • Co-funding insurance against flood • Co-funding insurance against hurricane • Co-funding insurance against fall frosts (only citrus plants from 01/09 through 30/11)	No Impact	No Impact
3	State Program Plant The Future	2015 - 2021	• New orchards of perennial plants including berry plantations • Installation of wells / boreholes and / or drip irrigation systems	Medium	Low
4	Tea Plantation Rehabilitation State Program “Georgian Tea”	2016 - 2021	• Removal of woody plants and weeds from the target tea plantation • Deep inter-row tillage (depth of 30 – 35cm) • Application of organic and mineral fertilizers • Application of pesticides if absolutely necessary	Low	Low
5	Co-financing of Processing and Storage Enterprises	2014 - 2021	• Establishment of new processing and storage facilities for agricultural produce • Rehabilitation of existing processing and storage facilities for agricultural produce	Low	Low
6	Farm / Farmers’ Registration Project	2018 - 2021	• Registration of farms / farmers	No Impact	No impact
7	State Programme for Technical Assistance	2016 - 2021	• Support to beneficiaries via trainings, assistance in certification, branding, trainings, participation in international exhibitions, technical equipment for agricultural cooperatives	No Impact	No impact

8	Program Supporting Development of Agricultural Cooperatives	2019 - 2021	• Funding for diary agricultural cooperatives – milk processing equipment • Funding for bee-keeping agricultural cooperatives – honey processing equipment • Funding for viticultural cooperatives – grape processing equipment	No Impact	No impact
9	Diary Modernization and Market Access State Program (DIMMA)	2020 - 2021	• Establishment of new dairy farms • Modernization / expansion of existing dairy farms • Purchase agricultural equipment / machinery to prepare food for livestock • Funding veterinary and artificial insemination	Low to medium	Low to medium
10	State Programme of Co-financing Agricultural Mechanization	2019 - 2021	• Purchase of harvesting equipment / machinery • Funding of land cultivation machinery such as agricultural and manual tractors, tractor implements and motorized machinery for rehabilitation of arable land	Low to medium	Low to medium
11	Imereti Agrozone	2020 - 2025	• Development of greenhouse cluster with all associated infrastructure (roads, power & gas supply, sewage system, drainage and irrigation system, fencing, ground surface levelling, etc.) on 220 ha in Tskhaltubo and Baghdati municipalities • Establishment of Dairy cattle farm on 125 ha land in Tsakhaltubo municipality • Setup of Gardening centre including gardening school and showroom • Logistics and sales centre • Provision of "single-window" service (customs, public registry, food safety agency, and other state and third party services) for cluster members	High	High
12	Agriculture Modernization, Market Access and Resilience Project (AMMAR)	2016 - 2021	• Establishment of new processing and storage facilities • Modernization of existing processing and storage facilities	Low	Low

13	Green Grants Programme	2021	• Funding for full envelope insulation • Funding for envelope insulation – 1st floor only/floor of attic/ceiling of basement • Funding for simple solar water and solar air heaters • Funding for industrial solar water heaters	No Impact	No impact
14	Agricultural Land Owner Support Program	2020 - 2021	• Funding for land tillage • Funding for application of fertilizers • Funding application of pesticides	Medium	Medium
15	"Young Entrepreneur"	2018 - 2021	• Setup of livestock and other farms • Setup of vineyards • Setup of agricultural produce processing facilities including family wineries • Setup of refrigerating storage facilities	Medium to High	Medium to High
16	Agro-diesel Support Program	2020 - 2021	• Provision of landowners with diesel fuel at reduced price aimed at intensification of arable land cultivation	Medium	Medium
17	State Programme for Supporting Agricultural Production	2020	• Funding for purchase of agricultural machinery / equipment / plant aimed at stimulation of land cultivation intensification • Setup of new and modernization of existing greenhouses for indoor farming • Purchase / installation of annual crop irrigation systems	Low to medium	Low to medium
18	Improving Rural Development in Georgia	2020 - 2021	• Funding for non-agricultural economic activity in rural areas • Co-funding renewable energy and energy-efficient projects	Low	Low
19	One-off Assistance for Hail-induced Damage in Kakheti Region	2021	• Compensation for harvest and crop damage caused by hail storms, which occurred in Kakheti region on 26/08 and 02/09/2021	No Impact	No impact
20	Industrial Apple Sale Promotion Program	2021	• Subsidies to fruit-processing facilities buying industrial apple	No Impact	No impact
21	State Programme for Wheat Flour Subsidy	2020 - 2021	• Subsidies to programme beneficiaries to maintain bread price	No Impact	No impact

4.1.1 Preferential Agrocredit

This large-scale and diverse program provides co-funding for numerous agricultural activities starting from establishment of new annual and perennial crop plantations, primary agricultural facilities / farms, to setup / modernization of processing and infrastructural facilities.

One of the major components of this program covers establishment of annual and new perennial crop plantations. Crop cultivation is associated with the following activities harmful to biodiversity:

1. Tillage including inter-row tillage
2. Application of fertilizers
3. Application of pesticides.

Prior to tillage site intended for crop cultivation is cleaned of all existing vegetation. In addition, tillage destroys the soil seed bank resulting in substantial decline and loss of populations of wild plants associated with agricultural ecosystems (predominantly segetal plants). This activity also disrupts food chain by destroying invertebrate fauna, which in turn reduces animal diversity higher at food chain. Tillage alters soil physical properties such as water content, aeration, compaction, porosity and temperature and renders soil susceptible to wind and water erosion, which affects level of organic matter and Nitrogen in the topsoil layer. Resultant soil losses can be substantial leading to de-vegetation, erosion and desertification.

All agricultural subsidy programs contain caveat that subsidized establishment and / or rehabilitation of perennial crop plantations (orchards) should be conducted in accordance with the recommendations and guidelines published by SRCA. One of key maintenance activities described in these guidelines refers to regular inter-row tillage and inter-row tillage combined with ciderate (cover crop / green fertilizer) seeding.

Key objective of inter-row tillage in orchards is to maintain loose soil structure throughout the year, which implies several tillage operations to a depth of 15-20cm with deep ploughing (depth of 55 – 60cm) implemented every four-five years. Application of this method amplifies negative impacts associated with tillage described above.

Inter-row tillage combined with cultivation of cover crops is likely to reduce organic and mineral fertilizer application volumes as cover crops enrich soil with nutrients. However, cover crops should be ploughed down into the soil to a depth of 10 – 15cm prior to flowering, which again increases impacts associated with tillage.

Application of fertilizers leads to water pollution and eutrophication affecting aquatic ecosystem. This activity also increases air pollution, acidification and mineral depletion of the soil. Use of fertilizers can suppress production of certain soil enzymes involved in nutrient cycles.

Pesticides affect species diversity at least in the area where they are applied and beyond if application is mismanaged or products are mobile. Pesticides can contaminate soil, water and vegetation. In addition to killing insects or weeds, pesticides can be toxic to a host of other organisms including birds, fish, beneficial insects, and non-target plants. Insecticides are generally the most acutely toxic class of pesticides, but herbicides can also pose risks to non-target organisms.

For the purpose of subsidy impact evaluation, it is assumed that beneficiaries follow recommendations of SRCA as indicated in subsidy application terms.

Potential negative impact associated with establishment of annual and new perennial crop plantations are evaluated as medium at ecosystem and species levels taking into consideration direct loss of non-crop habitat (which is likely predominantly already modified and of secondary

origin), loss of plant species and decline in wildlife associated with non-crop habitats, increased potential for plant invasions, contamination of soil and water due to leaching of fertilizers and pesticides, etc.

Another large and diverse component of this program is Primary Agricultural Facilities / Farms under Capital Assets. Agro credits for capital assets are issued for the purpose of establishment of new and / or expansion, upgrade and / or rehabilitation of existing facilities such as (1) processing facilities, (2) infrastructural facilities and (3) primary agricultural facilities / farms.

It should be noted processing and infrastructural facilities are evaluated to have presumably lower impacts on biodiversity than primary production facilities (farms) due to the following:

- Processing and infrastructural facilities require access to key infrastructure such as water, power and / or gas supply, sewage, etc. and they are likely to be located in / or in the immediate vicinity of residential areas in already heavily disturbed and modified environment.
- Setup of new and / or modernization of such existing facilities is subject to varying levels of environmental permitting. Consequently, consideration of potential associated impacts on biodiversity is part of decision-making process though level of permitting may be dependent on planned capacity.

Consequently, potential impacts of setup of new and / or modernization of processing and infrastructural facilities on biodiversity are regarded as low to medium on ecosystem and species level dependent on planned capacity.

The subcomponent of primary agricultural facilities is almost completely aimed at establishment or modernization of different agricultural farms such as large and small livestock farms, poultries, fisheries, etc and greenhouses.

Setup and / or rehabilitation of livestock farms are potentially associated with the following adverse impacts on biodiversity:

- Direct habitat loss resulting from establishment of new facilities and additional land take for rehabilitation of existing farms
- Increased pressure on pastures:
    - Removal of biomass
    - Trampling and destruction of plant root systems
    - Selective removal of palatable plant species by grazing livestock resulting in decline of native species richness
    - Facilitation of establishment of invasive plant species and abundant growth of weeds
    - Removal of predator species
    - Decline in wild grazers / herbivores
- Contamination of water and soil with increased organic waste including manure containing excessive salts, heavy metals, antibiotic residues, etc. All this affects organisms at lower food chain, which in turn are consumed by animals at higher trophic levels such as birds, rodents, etc.
- Increased water uptake affecting existing surface and groundwater resources eventually resulting in degradation of aquatic and semi-aquatic habitats and changes in groundwater table leading to water shortage in all habitats present in the locality
- Light pollution affecting insects, birds and mammals.
- Odour and air emissions. Livestock farming is a notorious major contributor to GHG emissions driving global climate changes affecting biodiversity at ecosystem and species level.

Potential negative impacts associated with establishment of new and / or rehabilitation of primary agriculture facilities / farms are evaluated as medium to high at ecosystem and species levels taking into consideration direct loss of non-crop habitat, loss of plant species and decline in wildlife, increased potential for plant invasions, contamination of soil and water due to leaching of fertilizers and pesticides, increased exploitation of water resources, etc.

In conclusion, Preferential Agrocredit program is associated with medium to high potential negative impacts on biodiversity taking into account the considerations discussed above.

4.1.2 State Program Plant the Future

Key part of this subsidy program is establishment of new orchards of perennial plants including installation of wells / boreholes and / or drip irrigation systems.

Potential negative impacts on biodiversity associated with establishment of new perennial crop plantations (orchards) are as follows:

- Destruction of established semi-natural plant communities
- Disturbance of associated animals
- Disruption of food chain and subsequent reduction of animal diversity
- Alteration of soil physical properties and reduction of nutrient availability leading to devegetation, erosion and desertification
- Water pollution and eutrophication of aquatic ecosystems
- Soil, water and vegetation contamination
- Loss of insects and subsequent adverse impacts on different animal and plant groups
- Increased potential for plant invasions, etc.

Similar to annual and perennial crop plantation component of Preferential Agrocredit subsidy, potential negative impact of this part of Plant the Future State Program are evaluated as medium at ecosystem and species levels taking into consideration direct loss of non-crop habitat (which is presumably already modified and of secondary origin), loss of plant species and decline in wildlife associated with non-crop habitats, increased potential for plant invasions, contamination of soil and water due to leaching of fertilizers and pesticides, etc.

Installation of wells / boreholes and / or drip irrigation systems involve additional water uptake from local surface and ground water sources. This leads to degradation of aquatic and semi-aquatic habitats and changes in groundwater table leading to water shortage in all habitats present in the locality.

Specific research findings indicate that conversion from flood or sprinkler irrigation to agricultural drip irrigation keeps water from replenishing aquifers, and may reduce locally available water; thus, water volumes applied to irrigated lands may fall, however, overall water depletions increase (Water conservation in irrigation can increase water use, Frank A. Ward & Manuel Pulido-Velazquez. 2008).

Overall, potential impacts of this subsidy program on biodiversity are assessed as medium on ecosystem level and low to medium on species level.

4.1.3 Georgian Tea Plantation Rehabilitation Program

Majority of potential adverse impacts of this program on biodiversity are associated with some agro-technical activities of rehabilitation of existing tea plantations. These activities are as follows:

1. Removal of woody plants and weeds from the target tea plantation

2. Deep inter-row tillage (depth of 30 – 35cm)
3. Application of organic and mineral fertilizers
4. Application of pesticides if absolutely necessary.

Potential negative impacts of the above activities are as follows:

- Destruction of established semi-natural plant communities
- Disturbance of associated animals
- Disruption of food chain and subsequent reduction of animal diversity
- Alteration of soil physical properties and reduction of nutrient availability leading to devegetation, erosion and desertification
- Water pollution and eutrophication of aquatic ecosystems
- Soil, water and vegetation contamination
- Loss of insects and subsequent adverse impacts on different animal and plant groups

In contrast to setup of new plantations, rehabilitation of existing tea plantations is considered to have low impact both on ecosystem and species levels.

4.1.4 Co-financing of Processing and Storage Enterprises

Potential impacts on biodiversity associated with establishment of new or rehabilitation of existing processing and storage facilities for agricultural produce are evaluated as low on ecosystem and species levels taking into account the following:

- Processing and storage facilities require access to key infrastructure such as water, power and / or gas supply, roads, sewage, etc. and they are likely to be located in / or in the immediate vicinity of residential areas in already heavily disturbed and modified environment with low biodiversity value.
- Setup of new and / or modernization of such existing facilities is subject to varying levels of environmental permitting. Consequently, consideration of potential associated impacts on biodiversity is part of decision-making process dependent on capacity.

4.1.5 Diary Modernization and Market Access State Program (DIMMA)

This state program provides subsidies to establish new or modernize / expand existing dairy farms and purchase agricultural equipment / machinery to prepare food for livestock. Another component is funding veterinary and artificial insemination – only this component is active at present.

Potential impacts on biodiversity related to setup and / or rehabilitation of livestock farms are:

- Direct habitat loss resulting from establishment of new facilities and additional land take for rehabilitation of existing farms
- Increased pressure on pastures:
    - Removal of biomass
    - Trampling and destruction of plant root systems
    - Selective removal of palatable plant species by grazing livestock resulting in decline of native species richness
    - Facilitation of establishment of invasive plant species and abundant growth of weeds
    - Removal of predator species
    - Decline in wild grazers / herbivores
- Contamination of water and soil with increased organic waste including manure containing excessive salts, heavy metals, antibiotic residues, etc. All this affects organisms at lower food chain, which in turn are consumed by animals at higher trophic levels such as birds, rodents, etc.

- Increased water uptake affecting existing surface and groundwater resources eventually resulting in degradation of aquatic and semi-aquatic habitats and changes in groundwater table leading to water shortage in all habitats present in the locality
- Light pollution affecting insects, birds and mammals.
- Odour and air emissions. Livestock farming is a notorious major contributor to GHG emissions driving global climate changes affecting biodiversity at ecosystem and species level.

They are assessed as low to medium for this program taking into consideration that target beneficiaries are small-scale milk producers.

4.1.6 State Programme of Co-financing Agricultural Mechanization

The component of this subsidy, which used to fund purchase of harvesting equipment / machinery, have low impacts on biodiversity as they are used in already cultivated crop land.

The renewed program, however, focuses on funding of land cultivation machinery such as agricultural and manual tractors, tractor implements and motorized machinery for rehabilitation of arable land. Use of all this equipment is highly likely to lead to intensification of land tillage. Associated potential adverse impacts comprise:

- Destruction of established semi-natural plant communities
- Disturbance of associated animals
- Disruption of food chain and subsequent reduction of animal diversity
- Alteration of soil physical properties and reduction of nutrient availability leading to devegetation, erosion and desertification

Potential negative impacts associated with intensification of arable land cultivation are evaluated as low to medium at ecosystem and species levels taking into account direct loss of non-crop habitat (predominantly already modified and of secondary origin), loss of plant species and decline in wildlife associated with non-crop habitats, increased potential for plant invasions, etc.

4.1.7 Imereti Agrozone

This new project aims at large-scale agricultural zone development on 345 ha of land located in Tskhaltubo and Baghdati municipalities of Imereti region.

The agricultural zone will include the following:

1. Greenhouse cluster with all associated infrastructure (roads, power & gas supply, sewage system, drainage and irrigation system, fencing, ground surface levelling, etc.) on 220 ha in Tskhaltubo and Baghdati municipalities
2. Dairy cattle farm on 125 ha land in Tsakhaltubo municipality
3. Gardening centre including gardening school and showroom
4. Logistics and sales centre
5. Provision of "single-window" service (customs, public registry, food safety agency, and other state and third-party services) for cluster members.

Imereti Agrozone development is a multi-year project with large-scale construction phase. The planned infrastructural development will require major earth works including ground surface levelling, trenching, building foundations, road construction, etc. Potential adverse impacts of construction works on biodiversity may range from high to severe due to loss of sizeable habitat area, habitat fragmentation and substantial transformation, removal of existing plant communities, disruption of wildlife ecological corridors, soil loss, etc.

Potential negative impacts associated with establishment of new dairy cattle farms are evaluated as medium to high at ecosystem and species levels taking into consideration direct

loss of non-crop habitat, loss of plant species and decline in wildlife, increased potential for plant invasions, increased exploitation of water resources, contaminated effluent discharge, etc.

As regards setup of greenhouse cluster, potential impacts on biodiversity are assessed as low due to the following: absence of tillage, reduced water consumption, reduced runoff with low contamination potential for the local soil, surface and ground water and hence, low impacts on terrestrial and aquatic habitats.

Other components of Imereti Agrozone are likely to have very low negative impacts on biodiversity as they imply provision of services within the constructed facilities.

In conclusion, implementation of Imereti Agrozone is associated with high potential adverse impacts on biodiversity taking into account the considerations discussed above.

4.1.8 Agriculture Modernization, Market Access and Resilience Project (AMMAR)

Components of this project with potential adverse impacts on biodiversity are establishment of new and modernization of existing processing and storage facilities. However, these impacts are evaluated as low taking into account that the target beneficiaries are smallholder farmers.

4.1.9 Agricultural Land Owner Support Program

Components of this program with potential negative impacts on biodiversity are provision of funding for land tillage and application of fertilizers and pesticides. These impacts are discussed in section 4.1.1. They are evaluated as medium taking into account short duration (1 year) and target beneficiaries of small landowners (1.25 to 10 ha).

4.1.10 "Young Entrepreneur"

Potential adverse impacts on biodiversity are associated with setup of livestock and other farms, vineyards, agricultural produce processing facilities including family wineries and refrigerating storage facilities.

Potential impacts of livestock farms on biodiversity include the following:

- Direct habitat loss resulting from establishment of new facilities and additional land take for rehabilitation of existing farms
- Increased pressure on pastures:
    - Removal of biomass
    - Trampling and destruction of plant root systems
    - Selective removal of palatable plant species by grazing livestock resulting in decline of native species richness
    - Facilitation of establishment of invasive plant species and abundant growth of weeds
    - Removal of predator species
    - Decline in wild grazers / herbivores
- Contamination of water and soil with increased organic waste including manure containing excessive salts, heavy metals, antibiotic residues, etc. All this affects organisms at lower food chain, which in turn are consumed by animals at higher trophic levels such as birds, rodents, etc.
- Increased water uptake affecting existing surface and groundwater resources eventually resulting in degradation of aquatic and semi-aquatic habitats and changes in groundwater table leading to water shortage in all habitats present in the locality
- Light pollution affecting insects, birds and mammals.

- Odour and air emissions. Livestock farming is a notorious major contributor to GHG emissions driving global climate changes affecting biodiversity at ecosystem and species level.

Potential adverse impacts associated with perennial crop plantations (vineyards) on biodiversity comprise the following:

- Destruction of established semi-natural plant communities
- Disturbance of associated animals
- Disruption of food chain and subsequent reduction of animal diversity
- Alteration of soil physical properties and reduction of nutrient availability leading to devegetation, erosion and desertification
- Water pollution and eutrophication of aquatic ecosystems
- Soil, water and vegetation contamination
- Loss of insects and subsequent adverse impacts on different animal and plant groups

Potential negative impacts associated with establishment of vineyards (new perennial crop plantations) are evaluated as medium at ecosystem and species levels taking into consideration direct loss of non-crop habitat (presumably already modified and of secondary origin), loss of plant species and decline in wildlife associated with non-crop habitats, increased potential for plant invasions, contamination of soil and water due to leaching of fertilizers and pesticides, etc.

Potential adverse impacts associated with establishment of new farms are evaluated as medium to high at ecosystem and species levels taking into consideration direct loss of non-crop habitat, loss of plant species and decline in wildlife, increased potential for plant invasions, effluent discharge, increased exploitation of water resources, etc.

Processing and refrigerating / storage facilities are likely to have low impacts on biodiversity considering the following: (1) these facilities require access to key infrastructure such as water, power and / or gas supply, roads, sewage, etc. and they are likely to be located in / or in the immediate vicinity of residential areas in already heavily disturbed and transformed environment with low biodiversity value and (2) set up of new facilities is subject to varying levels of environmental permitting, which reduces and mitigates anticipated impacts.

4.1.11 Agro-diesel Support Program

This short-term subsidy provided landowners with diesel fuel at reduced price. This program aimed to stimulate cultivation of arable land excluding pastures.

This subsidy resulted in intensification of tillage and amplification of the following associated impacts:

- Destruction of established semi-natural plant communities
- Disturbance of associated animals
- Disruption of food chain and subsequent reduction of animal diversity
- Alteration of soil physical properties and reduction of nutrient availability leading to devegetation, erosion and desertification.

Level of these impacts is evaluated as medium taking into account direct loss of non-crop habitat (likely already modified and of secondary origin), loss of plant species and decline in wildlife associated with non-crop habitats, increased potential for plant invasions, contamination of soil and water due to leaching of fertilizers and pesticides, etc.

4.1.12 State Programme for Supporting Agricultural Production

This state program includes three components.

The component providing funding for purchase of agricultural machinery / equipment / plant aims at stimulation of land cultivation intensification. The key activity associated with mechanization of land cultivation is tillage. Potential adverse impacts on biodiversity related to land tillage are:

- Destruction of established semi-natural plant communities
- Disturbance of associated animals
- Disruption of food chain and subsequent reduction of animal diversity
- Alteration of soil physical properties and reduction of nutrient availability leading to devegetation, erosion and desertification.

Potential impacts on ecosystem and species levels are evaluated as low to medium taking into account minor scale and duration (1 year) of the subsidy and assumption that this subsidy facilitated cultivation of formerly tilled arable land, which was temporarily uncultivated due to lack of resources.

Compared to outdoor crop farming, potential impacts on biodiversity resultant from the second component of this subsidy - setup of new and modernization of existing greenhouses are considered substantially lower due to the following: absence of tillage, reduced water consumption, reduced runoff with substantially lower contamination potential for the local soil, surface and ground water and hence, impacts on terrestrial and aquatic habitats. Consequently, potential impacts of new or modernized greenhouses on biodiversity are assessed to be low both on ecosystem and species levels.

Purchase / installation of annual crop irrigation systems, which is the third component of this state program is associated with additional load on local water resources, which is acknowledged to eventually lead to degradation of aquatic and semi-aquatic habitats and changes in groundwater table resulting in water shortage in all habitats present in the locality. However, modernized irrigation systems are likely to consume less water volumes for regular agricultural activities. Hence, potential negative impacts on ecosystem and species levels are evaluated as low.

Overall potential adverse impacts of this subsidy on biodiversity are of low to medium level.

4.1.13 Improving Rural Development in Georgia

This agricultural subsidy is composed of two components. One of the components with potential adverse impacts on biodiversity is provision of funding for non-agricultural economic activity in rural areas. However, there is no information on types of economic activity eligible for funding. Consequently, potential impacts cannot be identified and assessed at this stage.

The second component is co-funding renewable energy and energy-efficient projects. Renewable energy sources are wind and solar power. Wind turbines have adverse effects on wildlife including injury and death of birds and bats from turbine collisions, and the loss and fragmentation of species' habitat. However, these impacts are substantially lower as compared to those associated with power generation using fossil fuels.

Overall impacts associated with funding of renewable and energy-efficient projects on biodiversity are assessed as low both on ecosystem and species levels.

4.2 Quantification of Potential Adverse Impacts on Biodiversity for Subsidies with Specific Location Data

4.2.1 Loss of Biodiversity Potentially Associated with Subsidized Land Parcels

Land parcels subsidized by agricultural programs for which specific location data is available are assumed to partially support semi-natural grassland communities taking into account that key objective of all administered subsidies is to facilitate cultivation of formerly / temporarily abandoned agricultural land. Subsidized agricultural activities will likely result in direct loss of semi-natural grassland communities. Estimated areas of semi-natural grassland loss by agricultural subsidies are provided in Table 2 below based on assumptions detailed in Section 3.2.1.

Table 2. Estimated Acreage of Semi-natural Habitat Loss in Subsidized Land Parcels

Subsidy	Total Acreage of Subsidized Land Parcels, ha	Habitat Type on Subsidized Land	Total Habitat Loss on Subsidized Land, ha
State Program Plant the Future	6,962.98	Semi-natural grassland	2,320.99
Georgian Tea Plantation Rehabilitation Program	1,022.21	Semi-natural grassland	204.44
Imereti Agrozone	345	Semi-natural grassland	115.00
The Programme Supporting Young Entrepreneurs in Rural Area - Young Entrepreneur (vineyards, animal husbandry, dairy farms)	338.30	Semi-natural grassland	112.77
Total	**8,668.49**		**2,753.23**

NB RDA data on Co-financing of Processing and Storage Enterprises does not include information on areas occupied by enterprises (m^2 or ha) and their specific location within the subsidized land parcel; hence, habitat loss calculation cannot be conducted. Therefore, this subsidy has been excluded from analysis.

4.2.2 Potential Adverse Impacts of Subsidized Agricultural Activities on Biodiversity

In addition to direct impacts on habitats within the subsidized land parcels, most detrimental potential impacts associated with agricultural activities are those on sensitive habitats within the nearest biodiversity receptors such as Protected Areas, Emerald Network Sites, Georgian State Forest Fund, Key biodiversity areas, Important Bird Areas, Special protected areas for birds, Migrant bird rest areas. Sensitive habitats in biodiversity receptors are assumed to be affected by agricultural activities on subsidized land parcels located within 0-1km from the receptor perimeter via potential penetration and establishment of alien invasive and expansive plant species (Refer to Section 3.2.1). Habitat types present in the nearest biodiversity receptors from subsidized land parcels were identified using Vegetation Map of Georgia via ArcGIS analytical tools. It has been assumed that 20m-wide peripheral zone of biodiversity receptor is most susceptible in terms of biological invasions and establishment of expansive plant species. Total areas of potentially affected habitats are summarized in Table 3 below by habitat types and agricultural subsidies[19] and shown graphically in Figure 3.

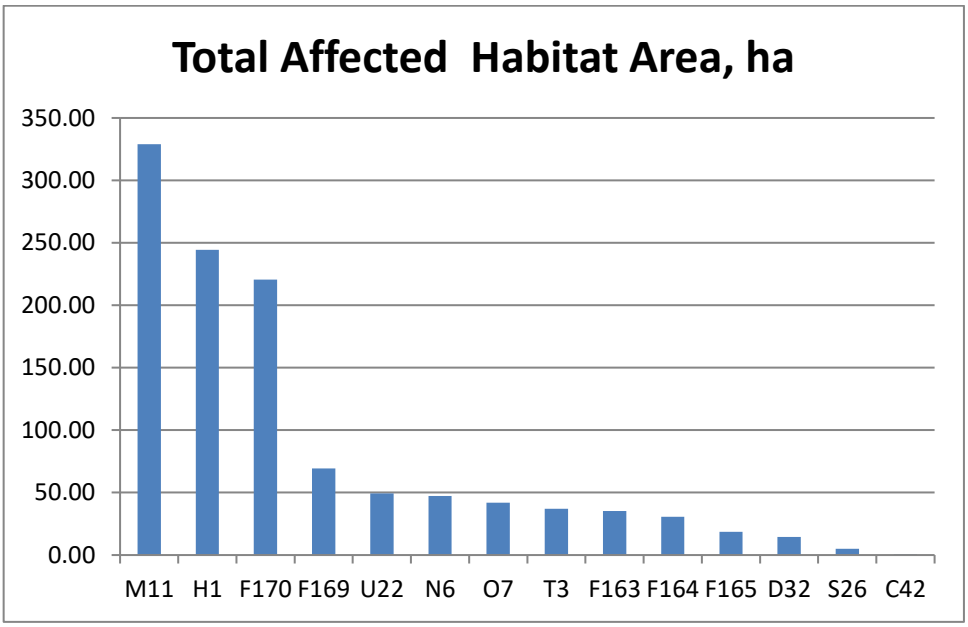
[19] Land parcels subsidized by Co-financing of Processing and Storage Enterprises located in 0-1km zone from sensitive biodiversity receptors were excluded from the above analysis as establishment and functioning of storage & processing facilities have no potential to facilitate penetration and establishment of invasive and expansive plant species.

Table 3. Summary Acreage Data on Potentially Affected Habitats for Subsidies with Specific Location Data

Agricultural Subsidy	Habitat Code	Habitat Type	Total Affected Habitat Area[20], ha
Plant the Future Young Entrepreneur	M11	Feather grass dominated steppes alternating with tomillares and tragacanthic communities	328.97
Plant the Future Imereti Agrozone	H1	Colchic lowland to submontane deciduous woodland with evergreen understorey	244.41
Plant the Future Young Entrepreneur	F170	South Caucasian Oakwoods, Hornbeam-Oak forest and Oriental Hornbeam-Oak forest locally combined with shibliak	220.59
Plant the Future Georgian Tea Plantation Rehabilitation Program	F169	East Euxinian oak and hornbeam-oak forests alternating with hornbeam-chestnut- beech forests	69.41
Plant the Future Young Entrepreneur	U22	Riparian woodlands	49.44
Plant the Future	N6	Tragacanthic vegetation and tomillares	47.29
Plant the Future	O7	Wormwood dominated communities with ephemeroids	42.03
Plant the Future	T3	Colchic Alder woods combined with riparian forests	36.94
Plant the Future	F163	East Euxinian-Caucasian Oriental beech forests	35.18
Plant the Future Young Entrepreneur	F164	Caucasian Beechwoods	30.53
Young Entrepreneur	F165	Submontane to montane Hornbeam- Maple-Beech forests combined with Hornbeam-Chestnut-Oak forests	18.60
Plant the Future	D32	Caucasian fir, spruce-fir and beech-fir forests with evergreen understorey frequently alternating with Beechwoods	14.56
Plant the Future	S26	Colchic tall Sedge fens combined with peatlands	4.93
Plant the Future	C42	Crook-stem woodlands, megaforbia and montane grasslands	0.57

[20] Area of 20m-wide peripheral part of the habitat

Figure 3. Habitat Ranking by Potential Impact Magnitude



As described in Section 3.2.1, it was assumed that agricultural activities carried out at subsidized land parcels located within 0 – 5km zone from the border of the nearest sensitive biodiversity receptor are likely to affect ecosystems and a number of animals taking into consideration mobility of different faunal species. Data on the subsidized land parcels identified within 0-5km zone from the nearest sensitive biodiversity receptors are summarized in Tables 4 – 8 below.

Table 4. Summary Data on Land Parcels in 0-5km zone from Sensitive Biodiversity Receptors & Habitats, Plant the Future

Sensitive Biodiversity Receptors &Habitats	Distance<1km		Distance 1-5 km	
	Number of Land Parcels	Total Area of Land Parcels ha	Number of Land Parcels	Total Area of Land Parcels ha
Protected Area	101	1,420.39	158	792.86
Emerald Site	89	542.30	302	1,550.29
KBAs	320	2,364.65	506	2,190.70
IBAs	134	2,704.52	201	1,012.82
SPAB	42	1,053.47	148	954.49
Ramsar Site	9	19.07	34	140.64
Bird Rest Area	99	970.61	68	315.31
Forest	257	1,920.88	588	2,090.22
B56	0	0.00	1	0.25
B58	0	0.00	1	0.64
C42	1	0.25	8	6.94
C44	0	0.00	8	88.90
C45	0	0.00	13	6.59
D32	7	4.85	29	19.06
D64	0	0.00	7	3.93

Sensitive Biodiversity Receptors &Habitats	Distance<1km		Distance 1-5 km	
	Number of Land Parcels	Total Area of Land Parcels ha	Number of Land Parcels	Total Area of Land Parcels ha
F163	9	5.87	55	44.15
F164	6	47.46	17	89.49
F165	0	0.00	11	36.85
F169	208	238.24	165	264.94
F170	85	616.22	176	1,131.67
H1	152	553.13	238	498.31
K33	0	0.00	25	487.54
M11	116	2,524.00	54	570.54
M4	0	0.00	2	4.27
N6	15	769.23	1	8.69
O7	21	299.74	22	203.93
S26	4	6.50	7	24.90
T3	33	67.33	82	257.35
U22	34	531.49	21	783.69

Table 5. Summary Data on Land Parcels in 0-5km zone from Sensitive Biodiversity Receptors & Habitats, Georgian Tea Plantation Rehabilitation Program

Sensitive Biodiversity Receptors &Habitats	Distance<1km		Distance 1-5 km	
	Number of Land Parcels	Total Area of Land Parcels ha	Number of Land Parcels	Total Area of Land Parcels ha
Protected Area	1	7.52	4	32.36
Emerald Site	0	0.00	26	154.18
KBA	27	62.94	33	112.09
IBA	0	0.00	0	0.00
SPAB	0	0.00	0	0.00
Ramsar Site	0	0.00	0	0.00
Bird Rest Area	0	0.00	0	0.00
Forest Fund	25	56.60	61	272.60
F163	0	0.00	12	102.25
F169	96	544.41	28	227.89
H1	0	0.00	8	48.61

Table 6. Summary Data on Land Parcels in 0-5km zone from Sensitive Biodiversity Receptors & Habitats, Imereti Agrozone

Sensitive Biodiversity Receptors &Habitats	Distance<1km		Distance 1-5 km	
	Number of Land Parcels	Total Area of Land Parcels ha	Number of Land Parcels	Total Area of Land Parcels ha
Protected Area	2	61.54	0	0.0
Emerald Site	2	61.54	0	0.0
KBA	2	61.54	0	0.0
IBA	0	0.00	0	0.0
SPAB	0	0.00	0	0.0
Ramsar Site	0	0.00	0	0.0
Bird Rest Area	0	0.00	0	0.0
Forest Fund	2	61.54	0	0.0
H1	2	61.54	0	0.0

Table 7. Summary Data on Land Parcels in 0-5km zone from Sensitive Biodiversity Receptors & Habitats, Young Entrepreneur

Sensitive Biodiversity Receptors &Habitats	Distance<1km		Distance 1-5 km	
	Number of Land Parcels	Total Area of Land Parcels ha	Number of Land Parcels	Total Area of Land Parcels ha
Protected Area	5	29.92	1	1.07
Emerald Site	10	20.86	69	99.46
KBA	55	152.77	65	75.42
IBA	50	108.25	62	81.55
SPAB	0	0	2	5.28
Ramsar Site	0	0	0	0
Bird Rest Area	1	47.00	1	0.15
Forest Fund	25	66.85	100	159.21
C44	0	0	2	0.45
F164	2	12.24	29	37.94
F165	9	25.32	58	77.95
F170	54	140.17	65	121.91
H1	0	0	1	0.45
M11	3	60.00	2	1.22
M4	0	0	1	0.30
U22	1	0.40	1	15.00

Table 8. Summary Data on Land Parcels in 0-5km zone from Sensitive Biodiversity Receptors & Habitats, Co-financing Storage & Processing Enterprises

Sensitive Biodiversity Receptors &Habitats	Distance<1km		Distance 1-5 km	
	Number of Land Parcels	Total Area of Land Parcels ha	Number of Land Parcels	Total Area of Land Parcels ha
Protected Area	4	22,188.5	4	48,141.0
Emerald Site	7	34,825.1	8	63,607.9
KBA	11	924,396.1	13	79,128.1
IBA	3	848,460.8	7	46,997.8
SPAB	1	2,881.4	7	887,981.1
Ramsar Site	0	0.0	1	22,562.7
Bird Rest Area	5	48,253.4	6	906,325.3
Forest Fund	7	29,710.9	15	158,010.1
C44	0	0.0	2	3,945.6
F164	1	2,506.1	2	2,440.0
F165	1	1,403.1	0	0.0
F169	2	8,498.7	4	8,937.7
F170	7	24,111.6	10	934,714.0
H1	5	62,629.8	4	12,818.5
K33	0	0.0	2	5,098.1
M11	2	860,214.9	4	43,962.7
O7	0	0.0	1	2,881.4
S26	1	22,562.7	0	0.0
T3	0	0.0	3	7,015.4
U22	1	2,881.4	2	10,799.5

Lists of animals including species with conservation status (listed in the IUCN Red List and Georgian Red List) associated with agricultural habitats, open landscapes and ecosystems present in sensitive biodiversity receptors were compiled by large animal groups (mammals, birds, reptiles, amphibians, insect pollinators) based on review of published literature and expert knowledge. Table 9 provides data on number of animal species for Georgia and areas where agricultural subsidies were implemented.

Table 9 Summary Data on Fauna in Georgia and Agricultural Subsidy Affected Areas

Animal Groups	Georgia		Areas Affected by Agricultural Subsidies			
	Number of Species	Number of Protected Species	Number of Species Potentially Present	Number of Protected Species Potentially Present	Number of Impacted Species	Number of Protected Impacted Species
Mammals	115	35	96	21	58	12
Birds	410	43	290	34	110	9
Reptiles	55	14	51	12	22	5
Amphibians	13	2	13	1	8	1
Insect pollinators	240	5	180	5	180	5

Figures 4-6 display ratios of animals including protected species in Georgia and areas affected by agricultural subsidies.

Figure 4 Comparison of Animal Species' Numbers, Georgia vs. Areas Affected by Agricultural Subsidies

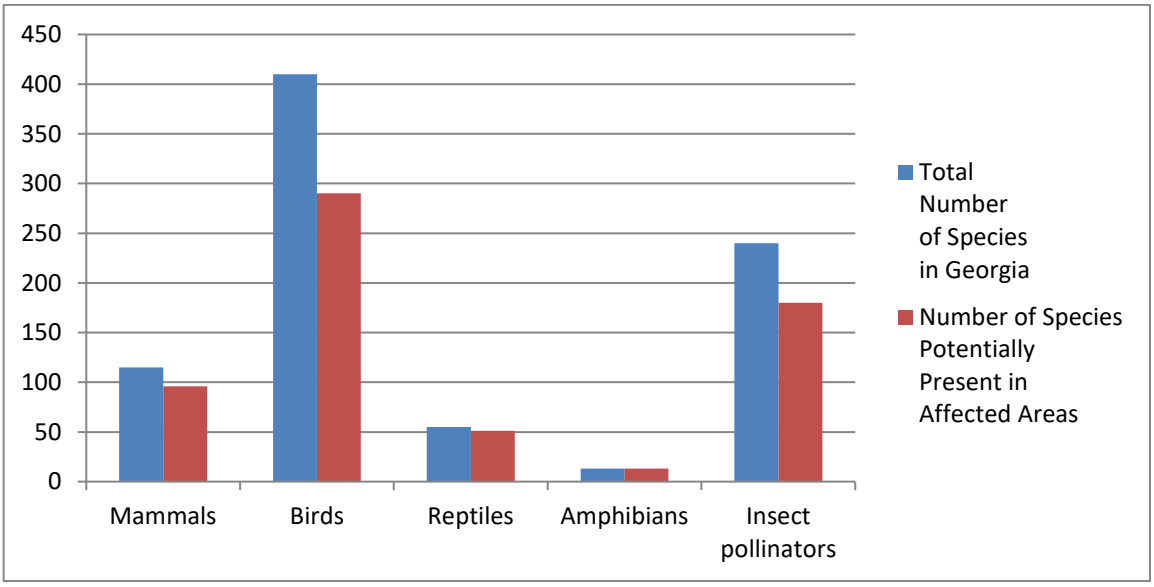


Figure 5 Comparison of Protected Animal Species' Numbers, Georgia vs. Areas Affected by Agricultural Subsidies

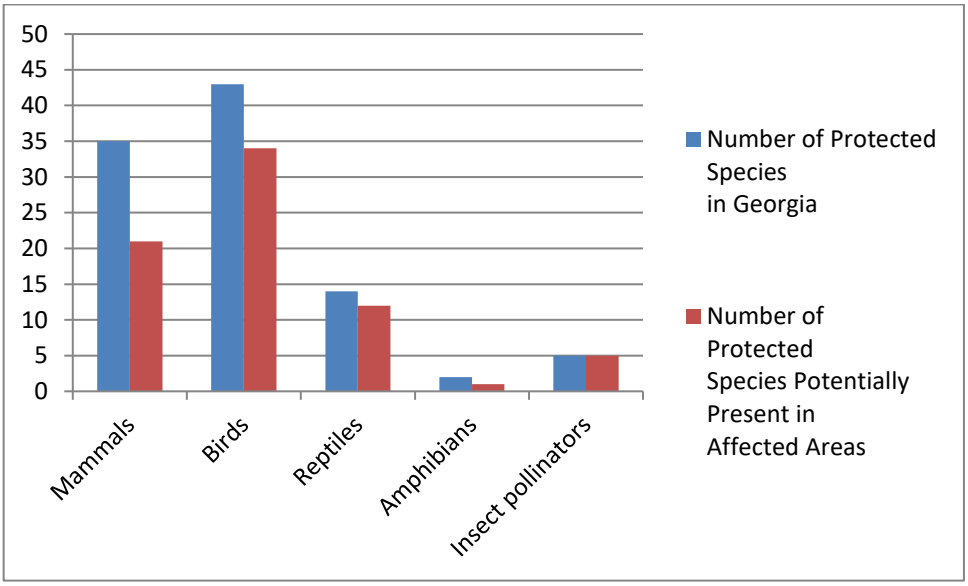
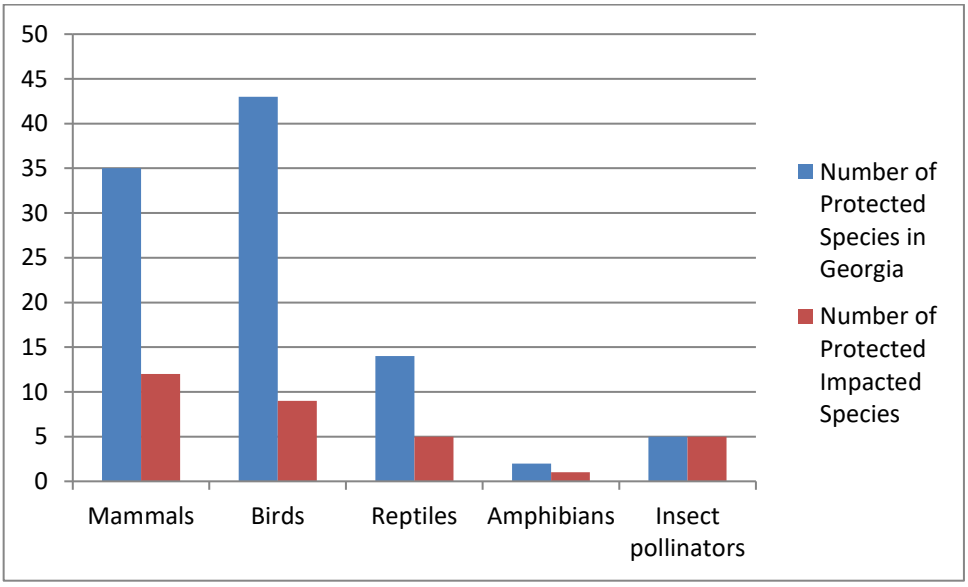


Figure 6 Protected Animal Species: Total in Georgia vs. Affected by Agricultural Subsidies

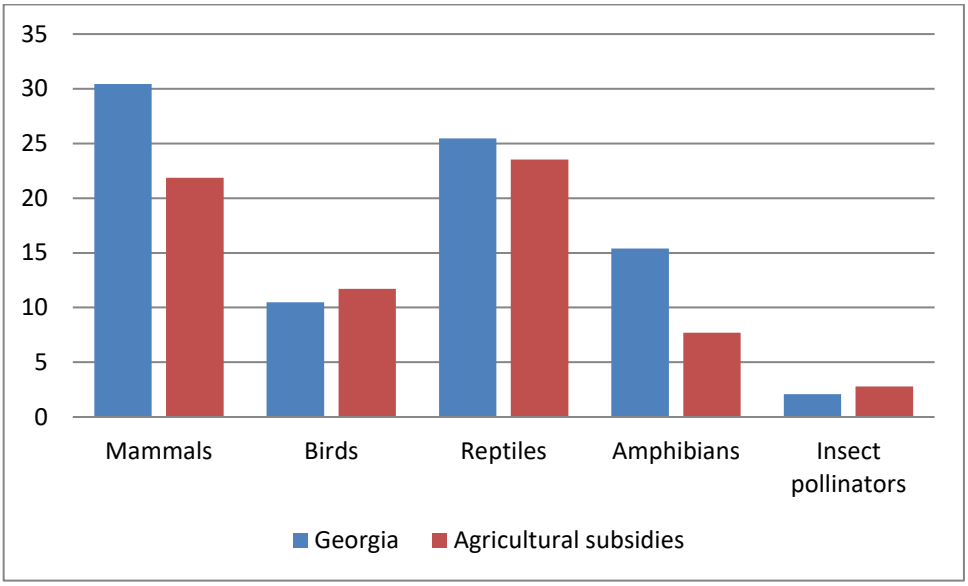


High proportion of animals[21] recorded in Georgia (up to 76% of all animals and 74% of species with protected status) is potentially present in areas affected by implemented agricultural subsidies. These figures clearly indicate that majority of the fauna is subject to potential impacts of varying scale associated with agricultural subsidies. Expert evaluation shows that approximately 45% of Georgia's faunal species and 32% of protected animals may be exposed to substantial adverse impacts resulting from subsidized agricultural activities.

CSI and IRII index values have been calculated as detailed in Section 3.2.1. Figure 7 is a graphical representation of proportions of protected animal species for Georgia and areas affected by agricultural subsidies. It shows that proportion of protected animal species is fairly high in almost all animal groups.

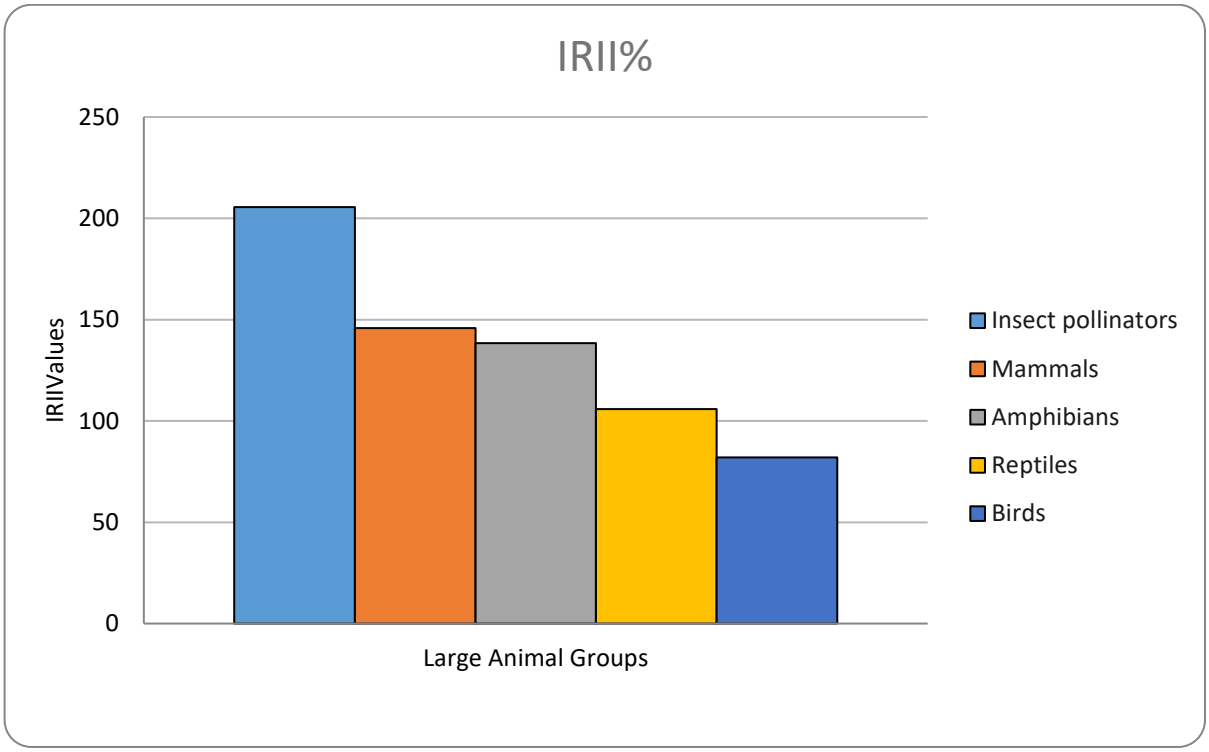
[21] Only the following large groups: mammals, birds, reptiles, amphibians and insect pollinators

Figure 7 CSI Values (%): Georgia vs. Areas Affected by Agricultural Subsidies



Interpretation of IRII values (Figure 8) indicates that implementation of agricultural subsidies is associated with substantially increased risk levels on all animal groups compared to the existing risk levels prior to commencement of subsidies.

Figure 8 IRII Values (%) by Large Animal Groups



4.3 Quantification of Potential Adverse Impacts on Biodiversity for Subsidies with No Specific Location Data

Agricultural subsidies with potential adverse impacts on biodiversity for which geographic information was not available have been subject to statistical analysis to identify scale of potential biodiversity loss. These subsidies are:

- Preferential Agrocredit
- DIMMA
- Co-financing Agricultural Mechanization
- AMMAR
- Supporting Agricultural Production.

Habitat types present within the sensitive biodiversity receptors have been identified based on the Vegetation Map of Georgia in order to calculate Affected Habitat Impact Index (AHI) as detailed in Section 3.2.2. Habitat type identification has been conducted in ArcGIS. Table 10 summarizes habitat types present in regions where the agricultural subsidies with no specific location data were implemented and potentially affected habitat areas.

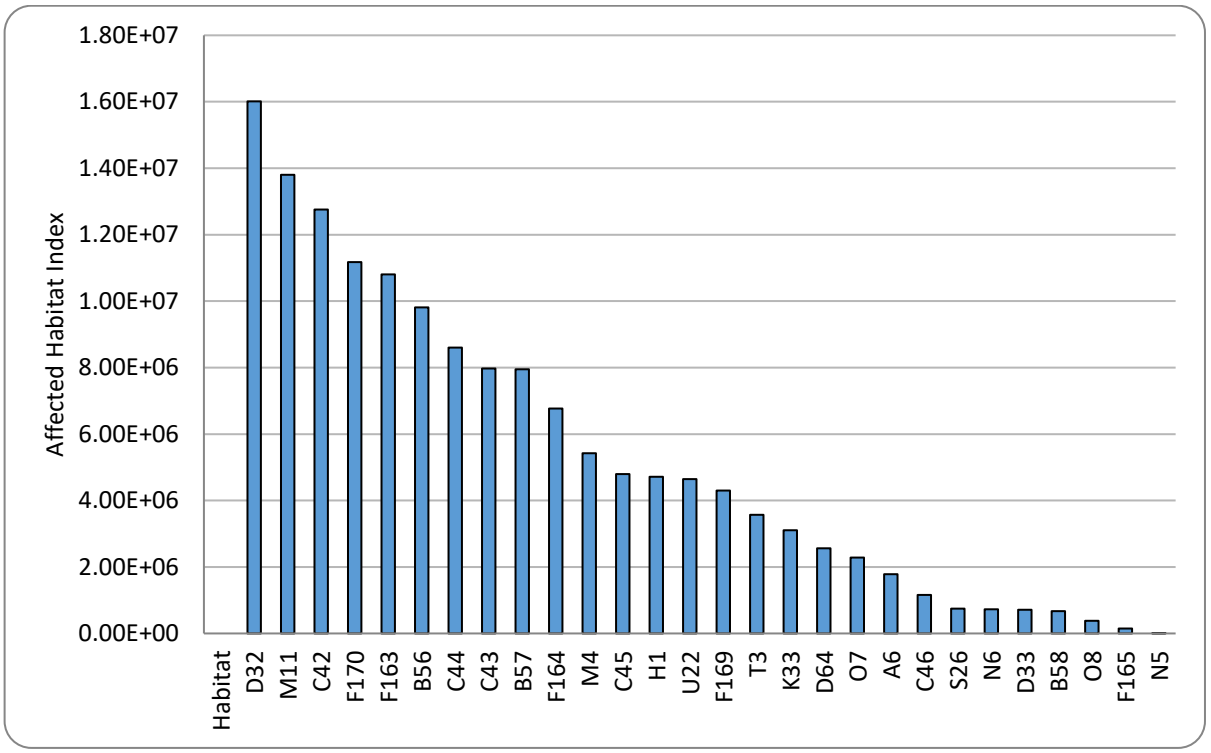
Table 10 Summary Data on Potentially Affected Habitats for Subsidies with No Specific Location Data

Habitat Code	Habitat Type	Potentially Affected Habitat Area, ha
D32	Caucasian fir, spruce-fir and beech-fir forests with evergreen understorey frequently alternating with Beechwoods	291,670.79
M11	Feather grass dominated steppes alternating with tomillares and tragacanthic communities	231,620.55
C42	Crook-stem woodlands, megaforbia and montane grasslands	210,484.78
F170	South Caucasian Oakwoods, Hornbeam-Oak forest and Oriental Hornbeam-Oak forest locally combined with shibliak	188,454.89
F163	East Euxinian-Caucasian Oriental beech forests	207,761.04
B56	West Caucasian Alpine grasslands, Rhododendron scrub and rock & scree vegetation	161,889.99
C44	Crook-stem woodlands, Rhododendron scrub, megaforbia & montane grasslands	153,549.65
C43	Crook-stem woodlands, Rhododendron scrub, megaforbia & montane grasslands alternating with dry grassland	142,587.06
B57	East Caucasian Alpine grasslands, Rhododendron scrub and rock & scree vegetation	140,259.95
F164	Caucasian Beechwoods	118,285.72
M4	Altimontane grassland and meadow-steppe	99,275.93
C45	Lesser Caucasian Crook-stem woodlands, Rhododendron scrub, megaforbia & montane grasslands	99,336.39
H1	Colchic lowland to submontane deciduous woodland with evergreen understorey	84,554.41
U22	Riparian woodlands	76,634.63
F169	East Euxinian oak and hornbeam-oak forests alternating with hornbeam-chestnut- beech forests	87,908.34

Habitat Code	Habitat Type	Potentially Affected Habitat Area, ha
T3	Colchic Alder woods combined with riparian forests	60,949.44
K33	Colline-montane juniper open woodlands	51,465.94
D64	Caucasian pine woods partly alternating with Birch and Spruce forests	43,922.42
O7	Wormwood dominated communities with ephemeroids	37,678.76
A6	Subnival vegetation	30,362.84
C46	Crook-stem woodlands, Juniper scrub, montane grasslands alternating with dry grasslands, steppes & tragacanthic vegetation	19,867.34
S26	Colchic tall Sedge fens combined with peatlands	12,764.93
N6	South Caucasian Tragancathic vegetation and tomillares	11,995.48
D33	Caucasian fir, spruce-fir and beech-fir forests with no evergreen understorey partly alternating with Beechwoods	13,299.32
B58	Lesser Caucasian Alpine grasslands, Rhododendron scrub and rock & scree vegetation	13,412.8
O8	Saltwort dominated communities with ephemeroids & Wormwood	6,280.63
F165	Submontane to montane Hornbeam- Maple-Beech forests combined with Hornbeam-Chestnut-Oak forests	2,449.05
N5	Greater Caucasian tragacanthic communities & tomillares	2.40
	Total Acreage Potentially Affected, ha	**2,598,725.47**

Figure 9 below shows ranking of habitats by potential impact magnitude associated with agricultural subsidies based on calculated AHI values.

Figure 9 Habitat Ranking by Potential Impact Magnitude



According to statistical ranking, three potentially worst affected habitats are as follows:

- D32: Caucasian fir, spruce-fir and beech-fir forests with evergreen understorey frequently alternating with Beechwoods – diverse woodland communities with distinct structure and associated rich flora and fauna.
- M11: Feather grass dominated steppes alternating with tomillares and tragacanthic communities – plant communities with fragmentary distribution supporting diverse species-rich modifications and high number of conservation value plants and animals.
- C42: Crook-stem woodlands, megaforbia and montane grasslands – unique plant communities in West Eurasia supporting high diversity of plant and animal species. Crook-stem woodlands are severely fragmented and modified due to heavy anthropogenic pressure.

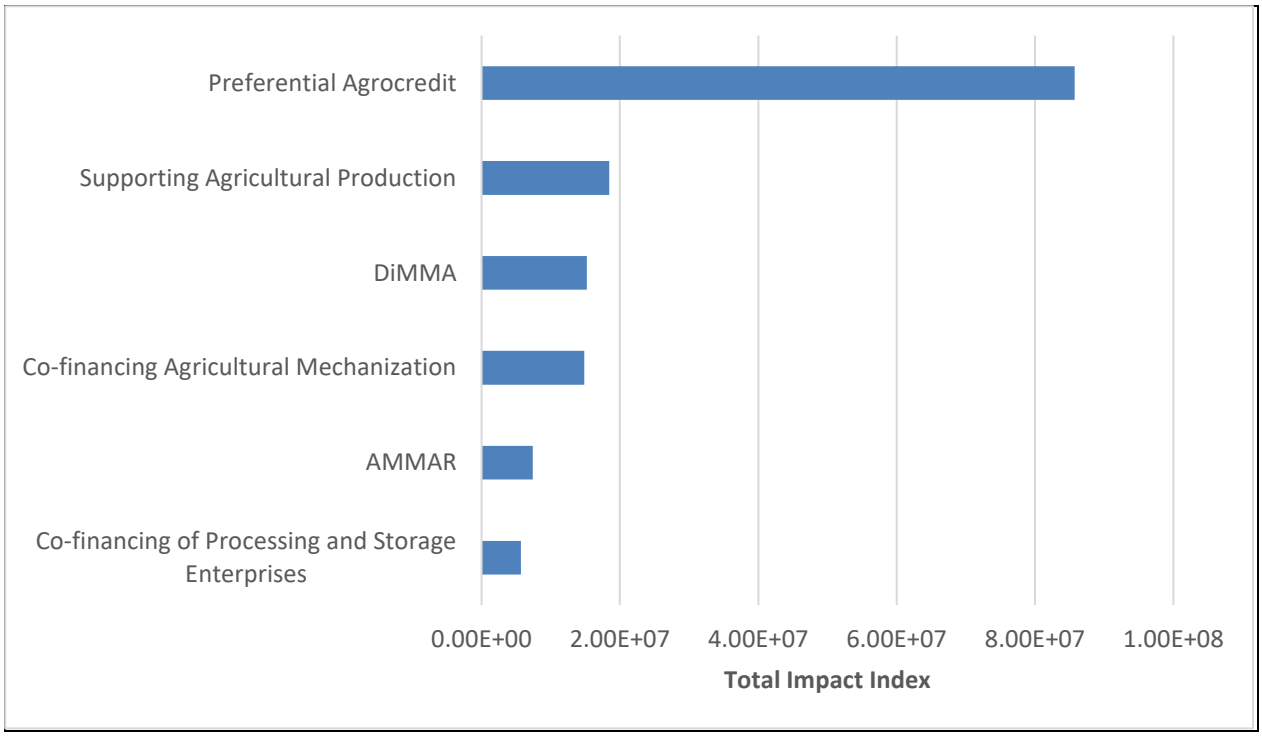
Table 11 provides a summary of Total Impact Index Values for subsidies with no specific location data while Figure 10 displays graphically subsidy ranking by potential impact magnitude on sensitive habitats. As anticipated, Preferential Agrocredit is shown to have the highest potential impact on biodiversity due to large scale and a wide array of activities subsidized.

Table 11 Total Impact Index Values for Subsidies with No Specific Location Data

Subsidy	Impact coefficient	Intensity coefficient	Total Affected Habitat Area, ha	Total impact Index
Preferential Agrocredit	7	4.71	2,598,725.47	85,754,775
DIMMA	3	2.51	2,016,222.77	15,209,665
Co-financing Agricultural Mechanization	3	2.42	2,041,958.63	14,844,503
AMMAR	1	2.85	2,597,706.39	7,403,550
Supporting Agricultural Production	3	2.58	2,383,007.40	18,475,441

Subsidy	Impact coefficient	Intensity coefficient	Total Affected Habitat Area, ha	Total impact Index
Co-financing of Processing and Storage Enterprises	1	2.20	2,597,706.41	5,704,303

Figure 10 Ranking of Subsidies with No Specific Data by Total Impact Index



5 Identification of Shortcomings of Current Programmatic Support Process Setup

Analysis of documents related to target agricultural subsidies and information collected via personal communication in the course of a number of stakeholder meetings indicate several key shortcomings in the current programmatic support process. They are as follows:

1. Need for evaluation of impacts of agriculture on biodiversity is not prioritized in strategic documents adopted for agricultural sector
2. Subsidy planning stage
    a. Absence of high-level assessment of potential impacts of the initiated subsidy on biodiversity
    b. Lack of synergy within the MEPA, viz.: between the departments of biodiversity and forestry, environmental assessment and RDA
3. No ecological or biodiversity-related criteria are used in subsidy application review process
4. Data on subsidy implementation monitoring collected by RDA is not digitized and therefore, not usable for analysis of associated impacts
5. Absence of monitoring of subsidy implementation before 2021 makes impossible analysis of success and shortcomings of past programs.

6 Social-economic Assessment of Biodiversity Impacts of Agricultural Subsidies

6.1 Social-economic Overview of Agricultural Subsidies

One of key factors for evaluation of social-economic impacts of subsidies is data on total funds spent per each subsidy, which is summarized in Table 12 below.

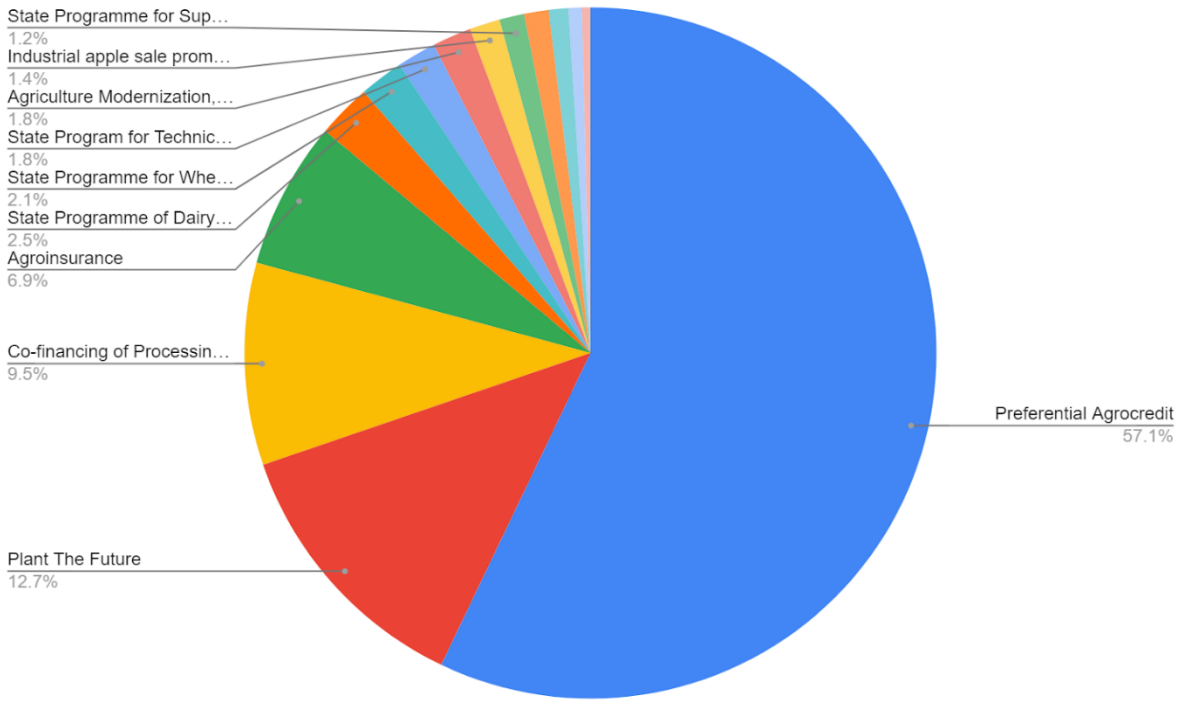
Table 12 Funds Spent by RDA-administered Agricultural Subsidies

Ref.	Program	Total Spent (GEL)	Average Spending by year (GEL)	Total Spent (USD)	Average Spending by year (USD)
1	Agro-diesel support programme	N/A	N/A	N/A	N/A
2	Preferential Agrocredit	476,523,832	52,947,092	182,462,187	20,273,576
3	Plant The Future	105,616,830	15,088,119	37,095,091	5,299,299
4	Co-financing of Processing and Storage Enterprises	78,897,293	9,862,162	28,848,343	3,606,043
5	Agroinsurance	57,466,719	7,183,340	23,400,195	2,925,024
6	State Programme of Dairy Modernization and Market Access (DIMMA)	21,109,766	10,554,883	6,719,967	3,359,983
7	State Programme for Wheat Flour Subsidy	17,240,000	8,620,000	5,350,000	2,675,000
8	State Program for Technical Assistance	15,211,399	5,070,466	5,054,430	1,684,810
9	Agriculture Modernization, Market access and Resilience project (AMMAR)	15,207,568	3,041,514	5,659,820	1,131,964
10	Industrial apple sale promotion programme	11,870,000	3,956,667	4,670,000	1,556,667
11	State Programme for Supporting Agricultural Production	9,651,127	9,651,127	3,104,258	3,104,258
12	The programme supporting young entrepreneurs in rural area - Young Entrepreneur	9,583,523	2,395,881	3,519,164	879,791
13	Programs Supporting Development of Agricultural Cooperatives	7,593,388	2,531,129	2,477,003	825,668
14	Improving Rural Development in Georgia	5,176,630	2,588,315	1,624,412	812,206
15	Tea Rehabilitation Program	3,395,976	565,996	1,215,586	202,598
	Total	834,544,052	134,056,691	311,200,457	48,336,887

Source: Rural Development Agency

Preferential Agrocredit comprises 57% of total funds spent on subsidies by RDA, followed by Plant the Future - 12.7% and Co-financing of Processing and Storage Enterprises - 9.5%. Out of 14 programs (excluding Agro-diesel Support Programme for which no data on total spent is available), the first four constitute over 85% of all the funds spent by RDA.

Figure 11 Subsidy Programs, % of Total Funding



Another important factor in evaluation of a socio-economic impact of a subsidy is number of unique beneficiaries. In total, some 260,000 beneficiaries received the RDA subsidies out of which 163,404 benefited from Agro-Diesel Support Program (according to the RDA, funds spent on this subsidy are not available as Socar Georgia - contractor company was responsible for fuel provision to beneficiaries). Excluding the Agro-Diesel Support Programme, number of beneficiaries of other RDA subsidies are some 96,000.

Table 13 RDA-administered Programs and Number of Beneficiaries

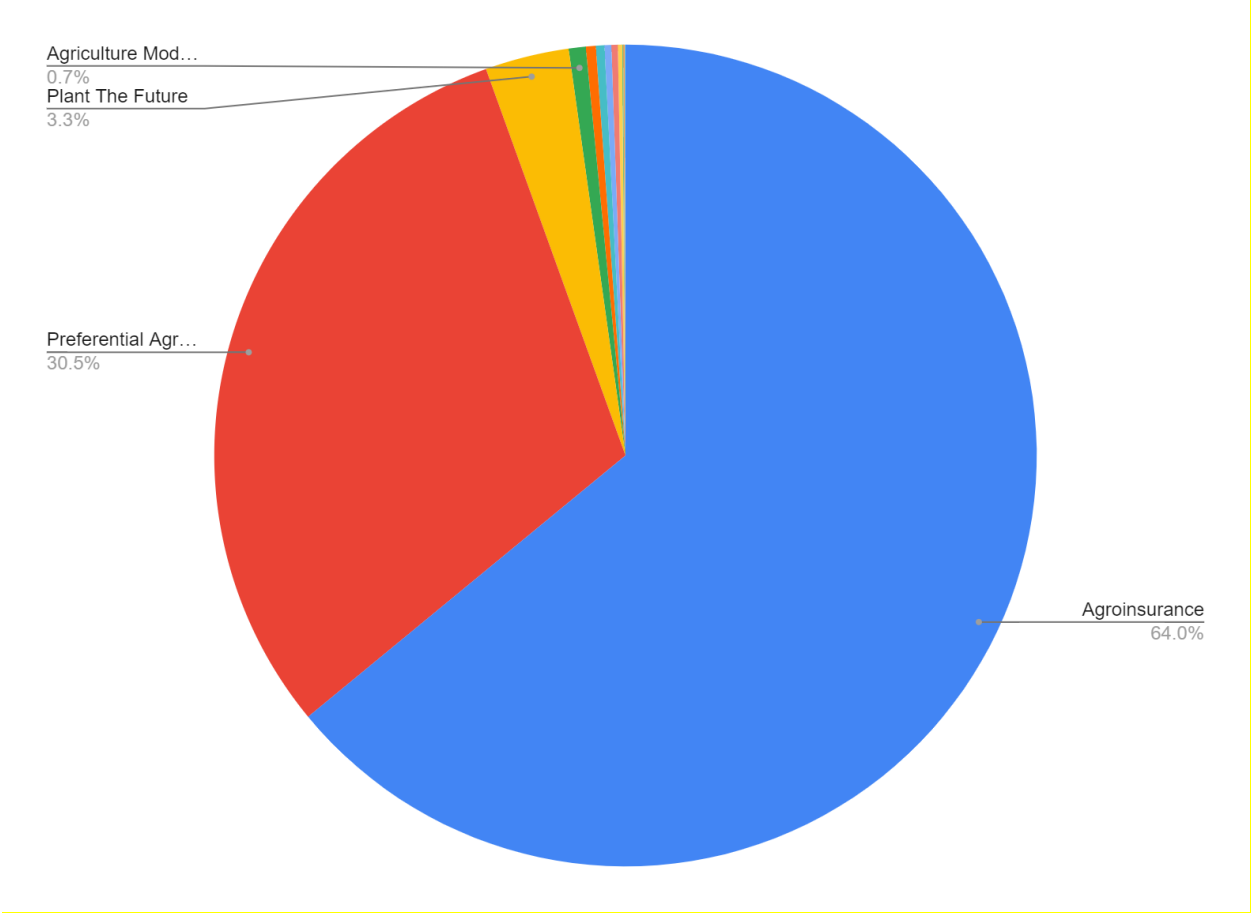
Ref.	Program	Number of Beneficiaries
1	Agro-diesel support programme	163,404
2	Agroinsurance	61,753
3	Preferential Agrocredit	29,374
4	Plant The Future	3,182
5	Agriculture Modernization, Market access and Resilience project (AMMAR)	643
6	State Programme for Supporting Agricultural Production	376
7	State Programme of Dairy Modernization and Market Access (DIMMA)	325
8	State Program for Technical Assistance	260
9	The programme supporting young entrepreneurs in rural area - Young Entrepreneur	242
10	Co-funding of Processing and Storage Enterprises	157
11	Tea Rehabilitation Program	49

Ref.	Program	Number of Beneficiaries
12	Improving Rural Development in Georgia	48
13	Programs Supporting Development of Agricultural Cooperatives	33
14	Industrial apple sale promotion programme	13
15	State Programme for Wheat Flour Subsidy	8
	Total	259,867

Source: Rural Development Agency

Agroinsurance has provided support to the highest number of beneficiaries - over 61,000. Preferential Agrocredit is second largest with some 30,000 beneficiaries followed by Plant the Future - over 3,100 beneficiaries. These three programs supported over 97% of unique beneficiaries.

Figure 12 Share of Unique Beneficiaries by the RDA Programs



Source: Rural Development Agency

An important factor in assessment of social-economic impacts of agricultural subsidies is funds spent per beneficiary as well as identification of programmes with highest amounts providing support to highest number of beneficiaries.

Table 14 Amount Spent per Beneficiary by Program

Ref.	Program	Funds per Beneficiary (GEL)	Funds per Beneficiary (USD)
1	State Programme for Wheat Flour Subsidy	2,155,000	668,750
2	Industrial apple sale promotion programme	913,077	359,231
3	Co-financing of Processing and Storage Enterprises	502,531	183,747
4	Programs Supporting Development of Agricultural Cooperatives	230,103	75,061
5	Improving Rural Development in Georgia	107,846	33,842
6	Tea Rehabilitation Program	69,306	24,808
7	State Programme of Dairy Modernization and Market Access (DIMMA)	64,953	20,677
8	State Program for Technical Assistance	58,505	19,440
9	The programme supporting young entrepreneurs in rural area - Young Entrepreneur	39,601	14,542
10	Plant The Future	33,192	11,658
11	State Programme for Supporting Agricultural Production	25,668	8,256
12	Agriculture Modernization, Market access and Resilience project (AMMAR)	23,651	8,802
13	Preferential Agrocredit	16,223	6,212
14	Agroinsurance	931	379

Source: Rural Development Agency

As evident from Table 14, most funds per beneficiary were spent in the programs which had the lowest number of beneficiaries. For example, in the Agro-insurance program, which provided support to 64% of all RDA beneficiaries, average funds per beneficiary was 931 GEL (379 USD). In contrast, the State Programme for Wheat Flour Subsidy program with almost 0% share in number of beneficiaries (8 beneficiary companies), funds per beneficiary spent exceeded 2,155,000 GEL (668,750 USD).

The following three criteria were assumed to evaluate social-economic impacts of agricultural subsidies:

1. Total Funds Spent
2. Number of Beneficiaries. Higher the number of beneficiaries, higher are associated social-economic impacts as one of the main objectives of the subsidy must be to cover as many people as possible giving preference to small farmers over large producers in the agricultural sector who frequently do not merit state subsidies.
3. Funds Spent per Beneficiary. Large budget subsidy providing support to few beneficiaries may indicate unequal distribution of benefits.

Table 15 Ranking Programs by Selected Criteria and Calculated Weighted Score

Ref.	Program	Rank in Total Funds Spent (33%)	Rank in Number of Beneficiaries (33%)	Rank in Funds per Beneficiary (33%)	Weighted Score
1	Tea Rehabilitation Program	1	10	6	5.66
2	Improving Rural Development in Georgia	2	11	5	5.99
3	Programs Supporting Development of Agricultural Cooperatives	3	12	4	6.33
4	State Programme for Supporting Agricultural Production	5	5	11	6.99
5	The programme supporting young entrepreneurs in rural area - Young Entrepreneur	4	8	9	6.99
6	Industrial apple sale promotion programme	6	13	2	6.99
7	Agriculture Modernization, Market access and Resilience project (AMMAR)	7	4	12	7.66
8	State Programme of Dairy Modernization and Market Access (DIMMA)	10	6	7	7.66
9	State Program for Technical Assistance	8	7	8	7.66
10	Co-funding of Processing and Storage Enterprises	12	9	3	7.99
11	State Programme for Wheat Flour Subsidy	9	14	1	7.99
12	Agroinsurance	11	1	14	8.66
13	Plant The Future	13	3	10	8.66
14	Preferential Agrocredit	14	2	13	9.66

Table 15 shows the programs which are most acceptable in socio-economic terms. Lower the weighted Score, more balanced is the subsidy in terms of beneficiary / funding ratio.

The following score scale was applied to calculate weighted scores of potential adverse impacts of subsidies on biodiversity (potential adverse biodiversity impact levels by the programs are summarized in Table 1).

- 'No impact' – 0 score
- Low impact – 1
- Low to medium impact – 3
- Medium impact – 5
- Medium to High – 7
- High – 10.

Table 16 Potential Biodiversity Impact Level Scores by Programs

Ref.	Program	Biodiversity Impact Level (Ecosystem) (50%)	Biodiversity Impact Level (Species) (50%)	Weighted Biodiversity Impact Level
1	The programme supporting young entrepreneurs in rural area - Young Entrepreneur	7	7	7
2	Preferential Agrocredit	7	7	7
3	State Programme for Supporting Agricultural Production	3	3	3
4	State Programme of Dairy Modernization and Market Access (DIMMA)	3	3	3
5	Plant The Future	5	1	3
6	Georgian Tea Plantation Rehabilitation Program	1	1	1
7	Improving Rural Development in Georgia	1	1	1
8	Agriculture Modernization, Market access and Resilience project (AMMAR)	1	1	1
9	Co-financing of Processing and Storage Enterprises	1	1	1
10	Programs Supporting Development of Agricultural Cooperatives	0	0	0
11	Industrial apple sale promotion programme	0	0	0
12	State Program for Technical Assistance	0	0	0
13	State Programme for Wheat Flour Subsidy	0	0	0
14	Agroinsurance	0	0	0

According to Table 16, The Programme Supporting Young Entrepreneurs in Rural Areas and Preferential Agrocredit are associated with highest negative impacts with five programs (NN 10-14) having no impact on biodiversity.

Two weighted scores reflecting biodiversity and social-economic impact levels have been combined in order to assess each subsidy.

Table 17 Overall Negative Impact Levels by Programs

Ref.	Program	Potential Biodiversity Impact Weighted Score (50%)	Potential Social-Economic Impact Weighted Score (50%) (Scaled)	Subsidy Impact Weighted Score
1	Preferential Agrocredit	7.0	6.7	6.8
2	The programme supporting young entrepreneurs in rural area - Young Entrepreneur	7.0	4.6	5.8
3	Plant The Future	3.0	5.9	4.4
4	State Programme of Dairy Modernization and Market Access (DIMMA)	3.0	5.1	4.1
5	State Programme for Supporting Agricultural Production	3.0	4.6	3.8
6	Co-financing of Processing and Storage Enterprises	1.0	5.4	3.2
7	Agriculture Modernization, Market access and Resilience project (AMMAR)	1.0	5.1	3.1
8	Agroinsurance	0.0	5.9	2.9
9	State Programme for Wheat Flour Subsidy	0.0	5.4	2.7
10	State Program for Technical Assistance	0.0	5.1	2.6
11	Improving Rural Development in Georgia	1.0	3.8	2.4
12	Industrial apple sale promotion programme	0.0	4.6	2.3
13	Georgian Tea Plantation Rehabilitation	1.0	3.6	2.3
14	Programs Supporting Development of Agricultural Cooperatives	0.0	4.1	2.0

Large-scale agricultural subsidies such as Preferential Agrocredit, Young Entrepreneur, Plant the Future and State Programme of Dairy Modernization and Market Access (DIMMA) appear to have highest potential adverse impacts both in biodiversity and social-economic terms. Oneoff crop-yield damage compensating subsidies (e.g., Industrial Apple Sale Promotion Program) and those with less harmful components such as provision of small-scale agricultural produce processing equipment (Programs Supporting Development of Agricultural Cooperatives) and rehabilitation of existing crop plantations (Tea Rehabilitation Program) are less damaging to biodiversity and also have positive effects on social-economic situation.

6.2 Monetary Value of Biodiversity Loss Associated with Subsidized Land Parcels

Subsidized land parcels are assumed to partially support semi-natural grassland communities taking into account that key objective of all administered subsidies is to facilitate cultivation of formerly / temporarily abandoned agricultural land. Subsidized agricultural activities will likely result in direct loss of semi-natural grassland communities. Table 2 in Section 4.2.1 provides estimated total acreage of semi-natural grassland habitat area for subsidized land parcels (agricultural subsidies with specific location data). For the purpose of calculation of monetary

value of semi-natural grassland loss a statistical bulletin of the UK Office for National Statistics – "Semi-natural Habitat Natural Capital Accounts[22] (UK, 2021) has been used (refer to Section 3.2.1). According to this source, semi-natural grassland habitat asset value per hectare is 33,649 GBP (43,744 USD). This value has been adjusted to derive value of similar ecosystem in Georgia using General Level of Prices (see Table 18).

Table 18 General Price Levels, UK vs Georgia

Country	GDP per Capita PPP[23] USD	GDP nominal USD
UK	47,089	46,200
Georgia	15,709	4,808
UK / Georgia	3.00	9.61
Difference between price levels		3.21

Source: IMF

After the adjustment of the price levels, semi-natural grassland habitat ecosystem asset value per hectare is $13,646 in Georgia (Table 19).

Table 19 Calculating Semi-natural Grassland Habitat Ecosystem Asset Value

Country	Area in hectares of semi-natural grassland habitat based on land cover classifications, UK, 2015	Semi-natural grassland habitat ecosystem asset values, £ million (2019 prices), UK, 2018	Semi-natural grassland habitat ecosystem asset values per ha, £ (2019 prices), UK, 2018	Semi-natural grassland habitat ecosystem asset values per ha, $ (2019 prices), UK, 2018
UK	8,017,827	269,792	£33,649	$43,744
Georgia			£10,497	$13,646

Source: UK Office of National Statistics & IMF

Monetary value of biodiversity loss on subsidized land parcels estimated on the basis of semi-natural grassland ecosystem asset value is given in Table 20 below.

[22] https://www.ons.gov.uk/economy/environmentalaccounts/bulletins/seminaturalhabitatnaturalcapitalaccountsuk/2021

[23] Purchasing Power Parity

Table 20 Estimated Monetary Value of Biodiversity Loss on Subsidized Land Parcels

Subsidy	Total Area of Subsidized Land, ha	Total Area of Semi-natural Grassland Habitat on Subsidized Land, ha	Estimated Value of Semi-natural Grassland Loss, USD	Estimated Value of Semi-natural Grassland Loss, GEL
Plant the Future	6,962.98	2,320.99	$31,672,505	101,352,017
Georgian Tea Plantation Rehabilitation Program	1,022.21	204.44	$2,789,813	8,927,400
Imereti Agrozone	345	115	$1,569,304	5,021,772
Young Entrepreneur	338.3	112.77	$1,538,873	4,924,393
Total	**8,668.49**	**2,753.20**	**$37,570,494**	**120,225,582**

The estimated values given above are an indication of monetary value of biodiversity loss per one hectare of semi-natural grassland in subsidized plots (Section 3.2.1). Table 20 shows that the highest estimated value of biodiversity loss in monetary terms is associated with implementation of the State Program “Plant the Future”; its estimated monetary value exceeds five times that of biodiversity loss associated with other three programs combined. This is primarily due to substantial difference in number of beneficiaries and total areas of respective subsidized land acreage between the programs.

6.3 Monetary Value of Affected Ecosystem Recovery Associated with Subsidized Land Parcels

As described in Section 3.2.1, agricultural activities in subsidized land parcels located 0-1km zone from the perimeter of the nearest sensitive biodiversity receptor may potentially affect 20m-wide peripheral zone in sensitive ecosystems (within biodiversity receptors) via penetration and establishment of invasive alien and expansive species. Ecosystems / habitats likely to be present in 20m wide peripheral zone of each potentially affected sensitive biodiversity receptor have been identified based on Vegetation Map of Georgia. Total acreage of potentially habitats is provided in Table 3 (Section 4.2.2).

For the purpose of monetary quantification of resultant biodiversity loss, costs of mechanical control of populations of such species were assumed as indication of biodiversity degradation recovery costs. It should be taken into consideration that IAPs and expansive plants suppress natural regeneration in woodland and scrub habitat and have very low impact on canopy layer (established trees) while they may substantially transform the floristic composition and structure of open habitats such as different modifications of grassland, wetland, etc. Therefore, monetary value of biodiversity degradation recovery in grassland and wetland also includes costs associated with native plant seed collection, propagation, seedling establishment and re-introduction into affected habitats to restore original structure and floristic composition.

A summary of estimated annual monetary value of affected ecosystem recovery by agricultural subsidies with specific location data is provided in Table 22 below with calculations and assumptions contained in Table 21.

Table 21 Calculations of Annual Monetary Values of Affected Ecosystem Recovery, Agricultural Subsidies with Specific Location Data

Calculation of Affected Ecosystem r

Table 22 Estimated Annual Monetary Values of Affected Ecosystem Recovery, Agricultural Subsidies with Specific Location Data

Subsidy	Habitat Code	Habitat Type	Disturbed Habitat Area, ha	Potential Impacts, Invasive Species Control & Habitat Restoration Measures	Cost GEL/ha	Cost USD/ha	Total Cost, GEL	Total Cost, USD	Annual Cost, GEL	Annual Cost, USD
Plant the Future	C42	Crook-stem woodlands, megaforbia and montane grasslands	0.57	Penetration & establishment of invasive & expansive species resulting in suppression of natural forest regeneration. The control measures are: (1) regular monitoring (3 times/year), (2) mechanical pulling of established specimens of invasive & expansive species (3 times / year during vegetation, flowering & fruiting of target species)	1,396	$436	794	$248	2,382	$744
Plant the Future	D32	Caucasian fir, spruce-fir and beech-fir forests with evergreen understorey frequently alternating with Beechwoods	14.56	Penetration & establishment of invasive & expansive species resulting in suppression of natural forest regeneration. The control measures are: (1) regular monitoring (3 times/year), (2) mechanical pulling of established specimens of invasive & expansive species (3 times / year during vegetation, flowering & fruiting of target species)	1,396	$436	20,323	$6,351	60,969	$19,053
Plant the Future	F163	East Euxinian-Caucasian Oriental beech forests	35.18	Penetration & establishment of invasive & expansive species resulting in suppression of natural forest regeneration. The control measures are: (1) regular monitoring (3 times/year), (2) mechanical pulling of established specimens of invasive & expansive species (3 times / year during vegetation, flowering & fruiting of target species)	1,396	$436	49,107	$15,346	147,322	$46,038

Subsidy	Habitat Code	Habitat Type	Disturbed Habitat Area, ha	Potential Impacts, Invasive Species Control & Habitat Restoration Measures	Cost GEL/ha	Cost USD/ha	Total Cost, GEL	Total Cost, USD	Annual Cost, GEL	Annual Cost, USD
Plant the Future	F164	Caucasian Beechwoods	23.43	Penetration & establishment of invasive & expansive species resulting in suppression of natural forest regeneration. The control measures are: (1) regular monitoring (3 times/year), (2) mechanical pulling of established specimens of invasive & expansive species (3 times / year during vegetation, flowering & fruiting of target species)	1,396	$436	32,707	$10,221	98,120	$30,662
Plant the Future	F169	East Euxinian oak and hornbeam-oak forests alternating with hornbeam-chestnut- beech forests	48.63	Penetration & establishment of invasive & expansive species resulting in suppression of natural forest regeneration. The control measures are: (1) regular monitoring (3 times/year), (2) mechanical pulling of established specimens of invasive & expansive species (3 times / year during vegetation, flowering & fruiting of target species)	1,396	$436	67,888	$21,215	203,664	$63,645
Plant the Future	F170	South Caucasian Oakwoods, Hornbeam-Oak forest and Oriental Hornbeam-Oak forest locally combined with shibliak	144.57	Penetration & establishment of invasive & expansive species resulting in suppression of natural forest regeneration. The control measures are: (1) regular monitoring (3 times/year), (2) mechanical pulling of established specimens of invasive & expansive species (3 times / year during vegetation, flowering & fruiting of target species)	1,396	$436	201,819	$63,068	605,457	$189,205

Subsidy	Habitat Code	Habitat Type	Disturbed Habitat Area, ha	Potential Impacts, Invasive Species Control & Habitat Restoration Measures	Cost GEL/ha	Cost USD/ha	Total Cost, GEL	Total Cost, USD	Annual Cost, GEL	Annual Cost, USD
Plant the Future	H1	Colchic lowland to submontane deciduous woodland with evergreen understorey	235.75	Penetration & establishment of invasive & expansive species resulting in suppression of natural forest regeneration. The control measures are: (1) regular monitoring (3 times/year), (2) mechanical pulling of established specimens of invasive & expansive species (3 times / year during vegetation, flowering & fruiting of target species)	1,396	$436	329,106	$102,846	987,317	$308,537
Plant the Future	M11	Feather grass dominated steppes alternating with tomillares and tragacanthic communities	319.08	Penetration & establishment of invasive & expansive species resulting in suppression of natural forest regeneration. The control measures are: (1) regular monitoring (3 times/year), (2) mechanical pulling of established specimens of invasive & expansive species (3 times / year during vegetation, flowering & fruiting of target species). In case substantial degradation of the habitat the restoration measures should be implemented including collecting seeds of local species, establishment of seedlings from wild collected seeds & their introduction into the affected habitat area to restore initial biodiversity and habitat structure	1,931	$603	616,145	$192,545	1,848,436	$577,636

Subsidy	Habitat Code	Habitat Type	Disturbed Habitat Area, ha	Potential Impacts, Invasive Species Control & Habitat Restoration Measures	Cost GEL/ha	Cost USD/ha	Total Cost, GEL	Total Cost, USD	Annual Cost, GEL	Annual Cost, USD
Plant the Future	N6	Tragacanthic vegetation and tomillares	47.29	Penetration & establishment of invasive & expansive species resulting in suppression of natural forest regeneration. The control measures are: (1) regular monitoring (3 times/year), (2) mechanical pulling of established specimens of invasive & expansive species (3 times / year during vegetation, flowering & fruiting of target species)	1,396	$436	66,019	$20,631	198,057	$61,893
Plant the Future	O7	Wormwood dominated communities with ephemeroids	42.03	Penetration & establishment of invasive & expansive species resulting in suppression of natural forest regeneration. The control measures are: (1) regular monitoring (3 times/year), (2) mechanical pulling of established specimens of invasive & expansive species (3 times / year during vegetation, flowering & fruiting of target species). In case substantial degradation of the habitat the restoration measures should be implemented including collecting seeds of local species, establishment of seedlings from wild collected seeds & their introduction into the affected habitat area to restore initial biodiversity and habitat structure	1,396	$436	58,669	$18,334	176,006	$55,002

Subsidy	Habitat Code	Habitat Type	Disturbed Habitat Area, ha	Potential Impacts, Invasive Species Control & Habitat Restoration Measures	Cost GEL/ha	Cost USD/ha	Total Cost, GEL	Total Cost, USD	Annual Cost, GEL	Annual Cost, USD
Plant the Future	S26	Colchic tall Sedge fens combined with peatlands	4.93	Penetration & establishment of invasive & expansive species resulting in suppression of natural forest regeneration. The control measures are: (1) regular monitoring (3 times/year), (2) mechanical pulling of established specimens of invasive & expansive species (3 times / year during vegetation, flowering & fruiting of target species). In case substantial degradation of the habitat the restoration measures should be implemented including collecting seeds of local species, establishment of seedlings from wild collected seeds & their introduction into the affected habitat area to restore initial biodiversity and habitat structure	1,931	$603	9,513	$2,973	28,539	$8,919
Plant the Future	T3	Colchic Alder woods combined with riparian forests	36.94	Penetration & establishment of invasive & expansive species resulting in suppression of natural forest regeneration. The control measures are: (1) regular monitoring (3 times/year), (2) mechanical pulling of established specimens of invasive & expansive species (3 times / year during vegetation, flowering & fruiting of target species)	1,396	$436	51,572	$16,116	154,716	$48,349

Subsidy	Habitat Code	Habitat Type	Disturbed Habitat Area, ha	Potential Impacts, Invasive Species Control & Habitat Restoration Measures	Cost GEL/ha	Cost USD/ha	Total Cost, GEL	Total Cost, USD	Annual Cost, GEL	Annual Cost, USD
Plant the Future	U22	Riparian woodlands	45.37	Penetration & establishment of invasive & expansive species resulting in suppression of natural forest regeneration. The control measures are: (1) regular monitoring (3 times/year), (2) mechanical pulling of established specimens of invasive & expansive species (3 times / year during vegetation, flowering & fruiting of target species)	1,396	$436	63,333	$19,792	190,000	$59,375
		Total (Plant the Future)					**1,566,995**	**$489,686**	**4,700,986**	**$1,469,058**
Georgian Tea Plantation Rehabilitation Program	F169	East Euxinian oak and hornbeam-oak forests alternating with hornbeam-chestnut- beech forests	20.78	Penetration & establishment of invasive & expansive species resulting in suppression of natural forest regeneration. The control measures are: (1) regular monitoring (3 times/year), (2) mechanical pulling of established specimens of invasive & expansive species (3 times / year during vegetation, flowering & fruiting of target species)	1,396	$436	29,002	$9,063	87,006	$27,189
		Total (Georgian Tea)					**29,002**	**$9,063**	**87,006**	**$27,189**
Imereti Agrozone	H1	Colchic lowland to submontane deciduous woodland with evergreen understorey	8.66	Penetration & establishment of invasive & expansive species resulting in suppression of natural forest regeneration. The control measures are: (1) regular monitoring (3 times/year), (2) mechanical pulling of established specimens of invasive & expansive species (3 times / year during vegetation, flowering & fruiting of target species)	1,396	$436	12,095	$3,780	36,286	$11,339
		Total (Imereti Agrozone)					**12,095**	**$3,780**	**36,286**	**$11,339**

Subsidy	Habitat Code	Habitat Type	Disturbed Habitat Area, ha	Potential Impacts, Invasive Species Control & Habitat Restoration Measures	Cost GEL/ha	Cost USD/ha	Total Cost, GEL	Total Cost, USD	Annual Cost, GEL	Annual Cost, USD
Young Entrepreneur	F164	Caucasian Beechwoods	7.10	Penetration & establishment of invasive & expansive species resulting in suppression of natural forest regeneration. The control measures are: (1) regular monitoring (3 times/year), (2) mechanical pulling of established specimens of invasive & expansive species (3 times / year during vegetation, flowering & fruiting of target species)	1,396	$436	9,908	$3,096	29,723	$9,288
Young Entrepreneur	F165	Submontane to montane Hornbeam- Maple-Beech forests combined with Hornbeam-Chestnut-Oak forests	18.60	Penetration & establishment of invasive & expansive species resulting in suppression of natural forest regeneration. The control measures are: (1) regular monitoring (3 times/year), (2) mechanical pulling of established specimens of invasive & expansive species (3 times / year during vegetation, flowering & fruiting of target species)	1,396	$436	25,961	$8,113	77,883	$24,339
Young Entrepreneur	F170	South Caucasian Oakwoods, Hornbeam-Oak forest and Oriental Hornbeam-Oak forest locally combined with shibliak	76.02	Penetration & establishment of invasive & expansive species resulting in suppression of natural forest regeneration. The control measures are: (1) regular monitoring (3 times/year), (2) mechanical pulling of established specimens of invasive & expansive species (3 times / year during vegetation, flowering & fruiting of target species)	1,931	$603	146,795	$45,873	440,384	$137,620

Subsidy	Habitat Code	Habitat Type	Disturbed Habitat Area, ha	Potential Impacts, Invasive Species Control & Habitat Restoration Measures	Cost GEL/ha	Cost USD/ha	Total Cost, GEL	Total Cost, USD	Annual Cost, GEL	Annual Cost, USD
Young Entrepreneur	M11	Feather grass dominated steppes alternating with tomillares and tragacanthic communities	9.89	Penetration & establishment of invasive & expansive species resulting in suppression of natural forest regeneration. The control measures are: (1) regular monitoring (3 times/year), (2) mechanical pulling of established specimens of invasive & expansive species (3 times / year during vegetation, flowering & fruiting of target species). In case substantial degradation of the habitat the restoration measures should be implemented including collecting seeds of local species, establishment of seedlings from wild collected seeds & their introduction into the affected habitat area to restore initial biodiversity and habitat structure	1,931	$603	19,104	$5,970	57,313	$17,910
Young Entrepreneur	U22	Riparian woodlands	4.07	Penetration & establishment of invasive & expansive species resulting in suppression of natural forest regeneration. The control measures are: (1) regular monitoring (3 times/year), (2) mechanical pulling of established specimens of invasive & expansive species (3 times / year during vegetation, flowering & fruiting of target species)	1,396	$436	5,685	$1,777	17,055	$5,330
		Total (Young Entrepreneur)					**207,453**	**$64,829**	**622,358**	**$194,487**

6.4 Extrapolation of Monetary Costs Calculated for Agricultural Subsidies with Specific Location Data to Programs with No Location Data

Extrapolation of monetary costs calculated for agricultural subsidies with specific location data (four subsidies in total) to programs with no location data (6 subsidies in total) was conducted taking into consideration number of agreements, which is available for all subsidies and indicates intensity and extent of subsidized agricultural activities. For the purpose of extrapolation, the following data of the four subsidies with specific location data were used:

- Number of agreements
- Costs of subsidy-affected ecosystem recovery (Section 4.2.2)
- Costs of biodiversity loss on subsidized land parcels (Section 4.2.1)
- Total costs of biodiversity degradation and loss (sum of the above two costs).

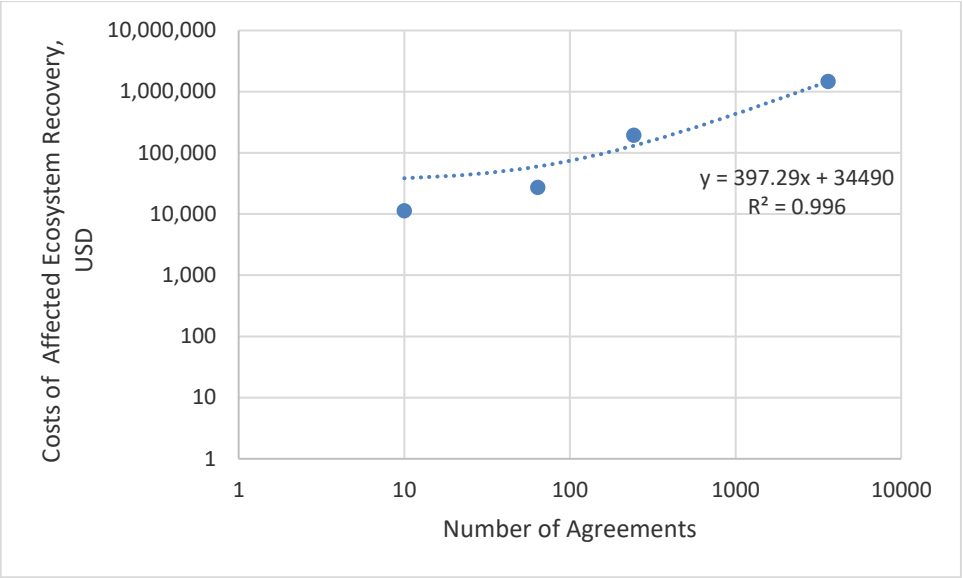
The input data (summary data from agricultural subsidies with specific location data) used for extrapolation of monetary costs of biodiversity loss and affected ecosystem recovery is summarized in Table 23 below.

Table 23 Input Data for Extrapolation of Costs of Biodiversity Loss and Affected Ecosystem Recovery for Subsidies with No Specific Location Data

Agricultural Subsidy	Affected Habitat Area, ha	Number of Agreements	Costs of Subsidy-Affected Ecosystem Recovery, USD	Costs of Biodiversity Loss on Subsidized Land, USD
Plant the Future	998.32	3,620	1,469,058	31,672,505
Georgian Tea Plantation Rehabilitation Program	20.78	64	27,189	2,789,813
Imereti Agrozone	8.66	10	11,339	1,569,304
Young entrepreneur	115.68	243	194,487	1,538,873

At the initial stage relationship between number of agreements and subsidy-affected ecosystem recovery costs was calculated (Figure 13). This relationship appeared extremely tight as indicated by the determination coefficient value (R^2) close to 1 (0.996). R^2=1 means that the regression predictions perfectly fit the data.

Figure 13 Relationship between Number of Agreements and Subsidy Affected Ecosystem Recovery Costs for Subsidies with Specific Location Data



Regression analysis produced the following equation for extrapolation:

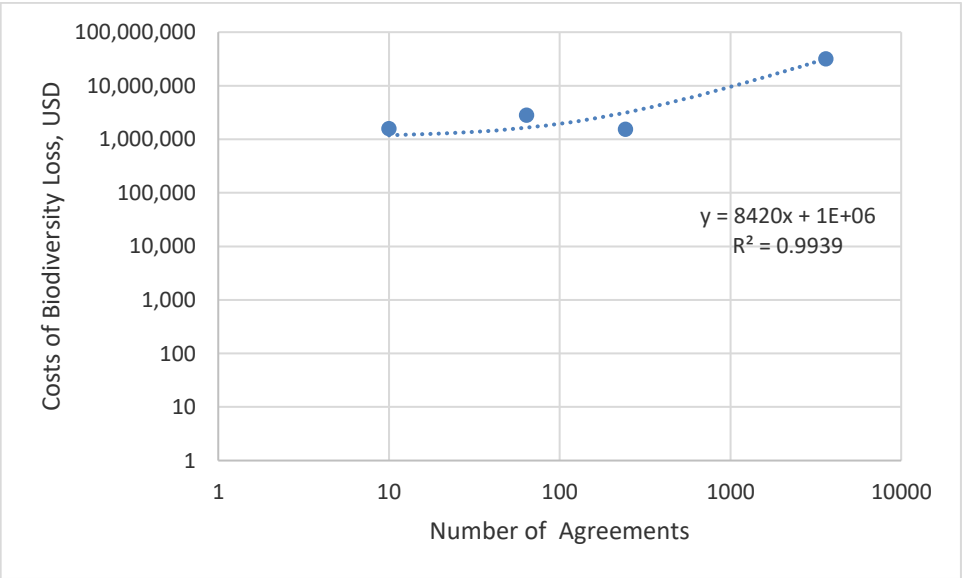
The subsidy-affected ecosystem recovery cost=397**number of agreements* +34,490.

Where 397 is calculated slope (ratio between values of Y and X coordinates in Figure 9)

34,490 is calculated intercept (Y value where the trend line intercepts with Y-axis in Figure 9).

Likewise, the relationship between the number of agreements and costs of biodiversity loss on subsidized land parcels appeared to be very tight with the determination coefficient (R^2) value as close to 1 as 0.9939. This means that the relationship is linear and valid for extrapolation (Figure 14).

Figure 14 Relationship between Number of Agreements and Costs of Biodiversity Loss on Subsidized land for Subsidies with Specific Location Data



Regression analysis produced the following model for extrapolation:

The cost of biodiversity loss on subsidized land=8,420**number of agreements* + 1,105,264

Where 8,420 is calculated slope
1,105,264 is calculated intercept.

Costs of direct biodiversity loss on subsidized land parcels and affected ecosystem recovery costs available for agricultural subsidies with geographical data have been extrapolated to estimate respective costs for agricultural subsidies with no specific location data using the above formulas (Table 24).

Table 24 Extrapolated Costs of Biodiversity Loss and Degradation Recovery for Subsidies with No Specific Location Data

Agricultural Subsidy	Number of Agreements	Affected Ecosystem Recovery Costs, USD	Biodiversity Loss Costs on Subsidized Land Parcels, USD	Total Costs of Biodiversity Loss and Affected Ecosystem Recovery, USD
Preferential Agrocredit	***51,774***	***20,588,768***	***436,990,570***	***457,579,338***
Plant the Future	3,620	1,469,058	31,672,505	33,141,563
Agroproduction Support	***384***	***186,938***	***4,338,160***	***4,525,098***
DIMMA	***327***	***164,309***	***3,858,277***	***4,022,586***
State Programme of Co-financing Agricultural Mechanization	***265***	***139,695***	***3,336,299***	***3,475,994***
AMMAR	***708***	***315,566***	***7,065,916***	***7,381,482***
Co-financing of Processing and Storage Enterprises	***157***	***96,819***	***2,427,047***	***2,523,866***
Young entrepreneur	243	194,487	1,538,873	1,733,360
Georgian Tea Plantation Rehabilitation Program	64	27,189	2,789,813	2,817,002
Imereti Agrozone	10	11,339	1,569,304	1,580,643

Agricultural subsidies with no specific location data are shown in bold italics

Table 24 above shows that five agricultural subsidies with the highest associated biodiversity impacts in monetary terms are as follows:

1. Preferential Agrocredit
2. Plant the Future
3. AMMAR
4. State Program for Supporting Agricultural Production
5. DIMMA.

7 Key Findings

Qualitative and quantitative analysis of potential adverse impacts on biodiversity and socio-economic environment resultant from implementation of on-going and planned agricultural subsidies can be summarized into the following main findings[24]:

- Total of 311.2 million USD was spent on 15 subsidy programs administered by the Rural Development Agency with average annual investment totalling 48.3 million USD. Preferential Agrocredit amounted to over 57% of the total funds allocated.
- In total, some 260,000 beneficiaries received an RDA subsidy. This is a fairly high beneficiary number taking into consideration that estimated total number of workforce in rural areas is up to 611, 400, which means that four out of ten workforce has benefited from RDA subsidy.
- Over 62% of 260,000 beneficiaries (Agro-diesel support programme) received fixed one-off assistance during a year, which is considered more a social subsidy than economic one. Up to 36% (i.e., 94,309 beneficiaries) benefited from Agroinsurance, Preferential Agrocredit and Plant the Future, which is regarded as more an economic subsidy than some kind of social benefit. These four RDA programs covered over 40% of the workforce in rural areas (mainly in the agricultural sector).
- Larger the subsidy funding, less the amount spent per beneficiary and vice versa. State Programme for Wheat Flour Subsidy pays the most per beneficiary (668,750 USD), which is 1,764 times higher than that of Agroinsurance that provides the lowest amount per beneficiary (379 USD) and 107 times higher than that of Preferential Agrocredit (6,212 USD per beneficiary). This means that some subsidies have socio-economic impact and some may have only economic impact without mass coverage.
  Agricultural subsidies with specific location data (four programs only: State Program Plant the Future, Georgian Tea Plantation Rehabilitation Program, Imereti Agrozone and The Programme Supporting Young Entrepreneurs in Rural Area - Young Entrepreneur (vineyards, animal husbandry, dairy farms)):
  - Direct potential biodiversity loss has been found to be fairly substantial, viz.: loss of biodiversity associated with semi-natural grassland present on subsidized land parcels occurred on a total area of 2,753 ha.
  - Semi-natural grassland ecosystem asset value in Georgia has been estimated to comprise 13,646 USD / ha based on UK Office of National Statistics calculations adjusted by Power Purchase Parity computed by the International Monetary Fund. This value has to be taken into consideration when planning new subsidies.
  - Estimated total monetary value of direct biodiversity loss is as high as 37.5M USD.
  - Indirect potential biodiversity loss (degradation of sensitive ecosystems present in the 20m wide peripheral part of the nearest sensitive biodiversity receptor due to penetration and establishment of invasive and expansive plant species from the subsidized land parcels) has been estimated to occur on 1,114 ha of 14 different sensitive ecosystems as a result of implementation of the four subsidies with specific location data.
  - Annual monetary values of affected ecosystem recovery have been calculated using the National Statistics Office of Georgia's data on average salaries of different personnel and costs of specific measures of habitat recovery and restoration. Estimated cost of invasive species control measures comprised 436 USD / ha in woodland and scrub habitats and cost of invasive species control & habitat restoration measures reached 603 USD / ha in wetlands and steppes.

[24] Potential socio-economic impacts of the reviewed agricultural subsidies have been evaluated by the following key criteria: (1) Total investment in agricultural subsidies, (2) number of unique beneficiaries and (3) an amount spent per beneficiary.

These costs should be taken into consideration when planning the subsidy projects.

- Estimated total monetary value of indirect biodiversity loss is 1,702,000 USD, which is a total annual cost of mechanical control and monitoring of invasive and expansive species and restoration of affected ecosystems involving propagation and re-introduction of ecosystem-specific plant species.

Agricultural subsidies with no specific location data (six programs: Preferential Agrocredit, DIMMA, Co-financing Agricultural Mechanization, Supporting Agricultural Production, Co-financing of Processing and Storage Enterprises, AMMAR):

- Statistical analysis based on extrapolation of the information from the four agricultural subsidies with specific location data shows the six subsidies will affect 28 different ecosystems present within the sensitive biodiversity receptors, which is substantial potential negative impact on biodiversity (up to 65% of all ecosystems of Georgia are potentially affected).
- Estimated (extrapolated) total monetary value of direct biodiversity loss resulting from implementation of the six agricultural subsidies with no specific location data is 458M USD.
- Estimated total monetary value of indirect biodiversity loss is 21.5M USD.

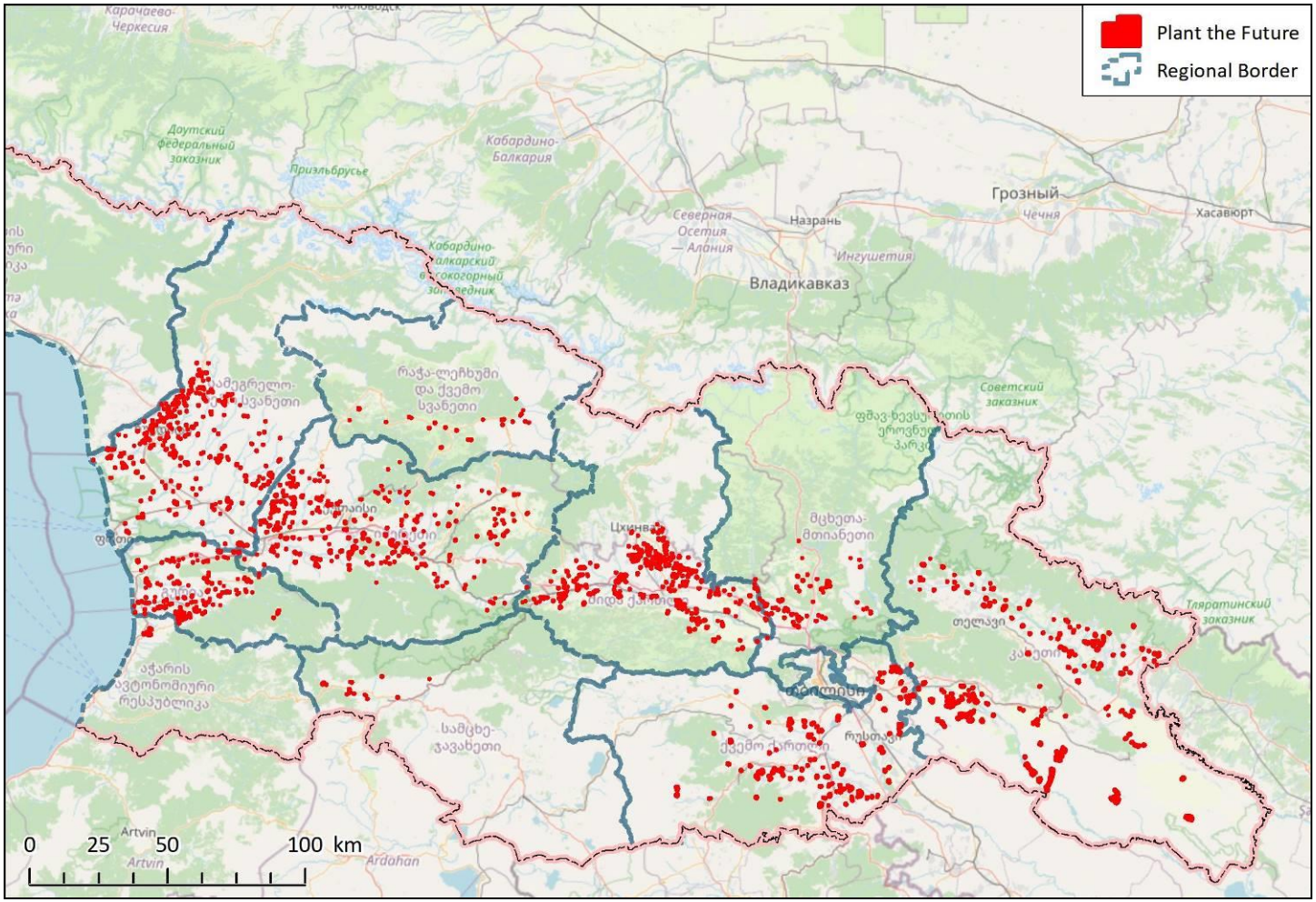
- High proportion of animals recorded in Georgia (up to 76% of all animals and 74% of species with protected status) is potentially present in areas affected by implemented agricultural subsidies.
- Expert evaluation shows that approximately 45% of Georgia's faunal species and 32% of protected animals may be exposed to substantial adverse impacts resulting from subsidized agricultural activities.
- Highest potential adverse impacts resulting from agricultural subsidies are predicted for insect pollinators and mammals.
- Preferential Agrocredit, Plant the Future, AMMAR, Supporting Agricultural production and DIMMA have been identified as the most biodiversity harmful programs based on review of available data and statistical analysis.

8 Identification of Solutions to Avoid/Mitigate Negative Consequences from Programs' Implementation

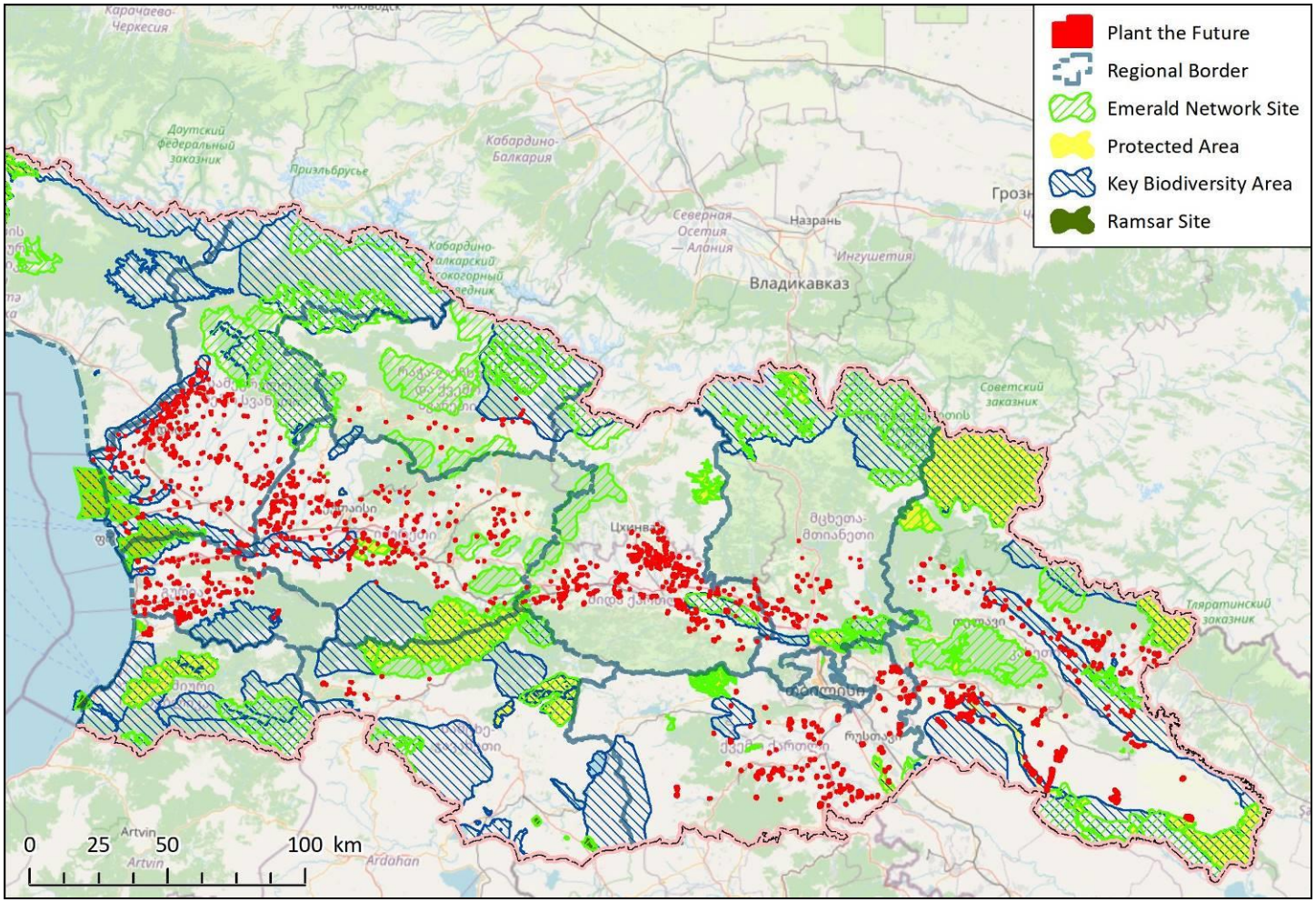
Detailed review of information on agricultural subsidies sourced from RDA and other public sources and series of consultations with key stakeholders (MEPA, RDA and SRCA representatives) formed basis for identification of recommendations aimed at improvement of subsidy administration process (including application review) and mitigation of anticipated potential negative impacts on biodiversity associated with the implementation of current and planned agricultural subsidies. These recommendations are summarized below:

- Development of a database of active / on-going agricultural subsidies in order to streamline monitoring of consequences of on-going and planned agricultural subsidies
- Identification of agricultural subsidies with potential high adverse impacts on biodiversity
    - Involvement of Departments of Biodiversity and Forestry and Environmental Assessment in the impact identification and evaluation process
    - Development of a checklist for assessment of potential negative impacts of planned / new agricultural subsidies
    - Discussion of a checklist with academic community & NGOs specializing in biodiversity impact assessment and conservation
    - Application of the checklist to on-going and / or new subsidies
- Development of application assessment criteria to identify and stimulate projects minimizing adverse impacts on biodiversity
    - Efficient water use, e.g., capturing and storing water, irrigation scheduling, use of compost and mulch, organic farming. Another consideration to apply is not using lakes as irrigation water source to minimize degradation of aquatic ecosystems. In addition, applications implying drainage of wetlands should not be funded
    - Use of renewable energy, e.g., use of solar panels
    - Organic farming practices
    - Use of rotational grazing in livestock farming
    - Use of land management practices such as planting hedgerows instead of fencing, retention of hedgerows and field margins with naturally established vegetation – potential shelter / corridor for movement for wildlife
- Minimization of potential contamination of soil and water:
    - Identification of potential waste streams and volumes and disposal options in applications
    - Tracking of applied volumes of fertilizers and pesticides and number of beneficiaries using these substances in agricultural production by program
- Initiation of economic assessment of biodiversity loss due to agricultural subsidies on national level
    - National inventory of major ecosystems to evaluate their economic value – potential source of expertise is UN Environment Programme World Conservation Monitoring Centre (UNEP-WCMC)
    - Consideration of presence of habitats of nationally and globally protected species (Georgian and IUCN Red Lists) in application evaluation process
    - Consideration of proximity to designated and planned protected areas, key biodiversity areas, Emerald sites, important bird areas, known locations of other species of conservation concern (e.g., Caucasian and Georgian endemics, rare and relic species, species of economic value, etc.) in application evaluation process
- Raising ecological awareness of potential agricultural subsidy beneficiaries with regard to importance of biodiversity conservation (e.g., interdependence of biodiversity and agricultural productivity).

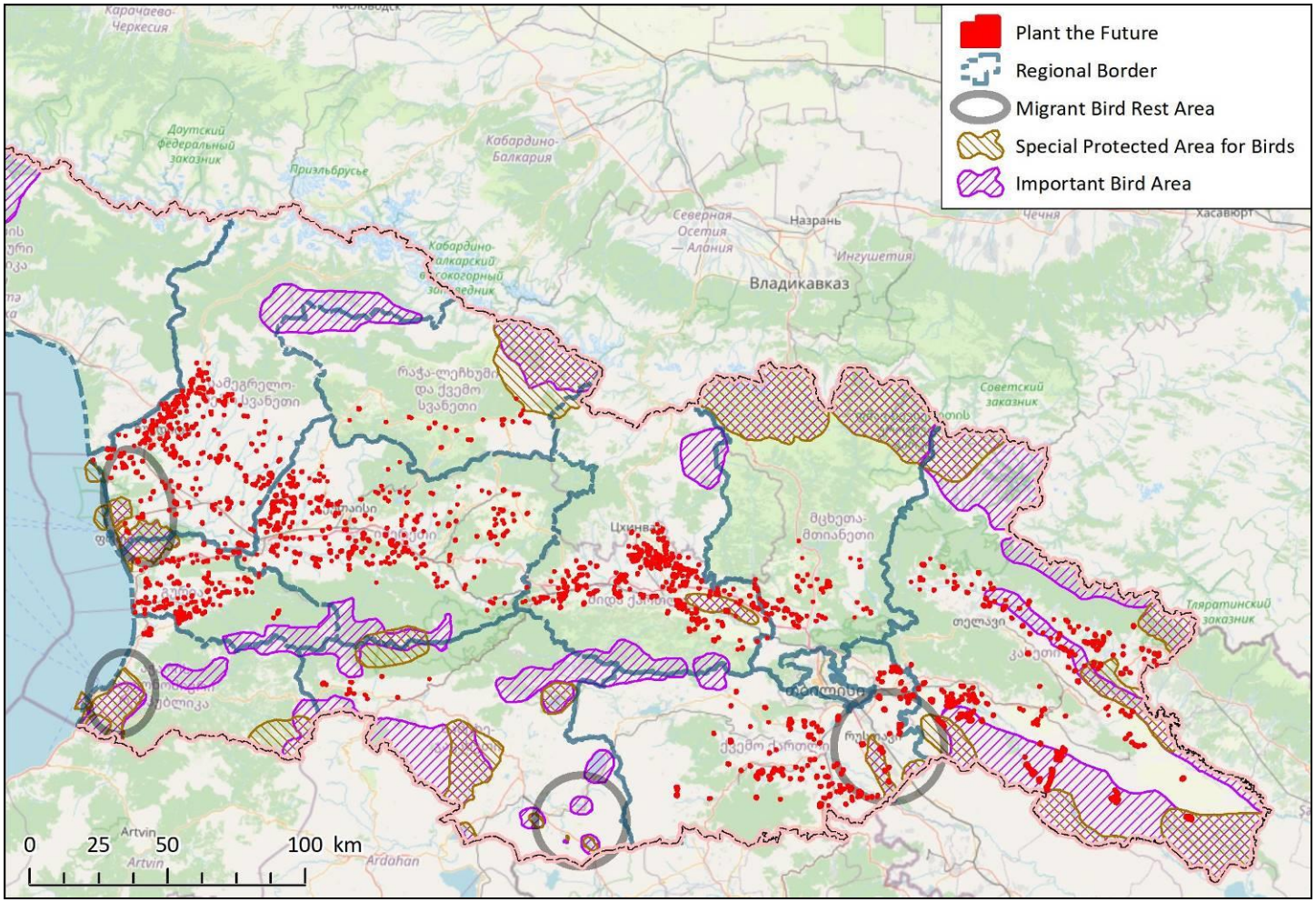
Appendix Maps



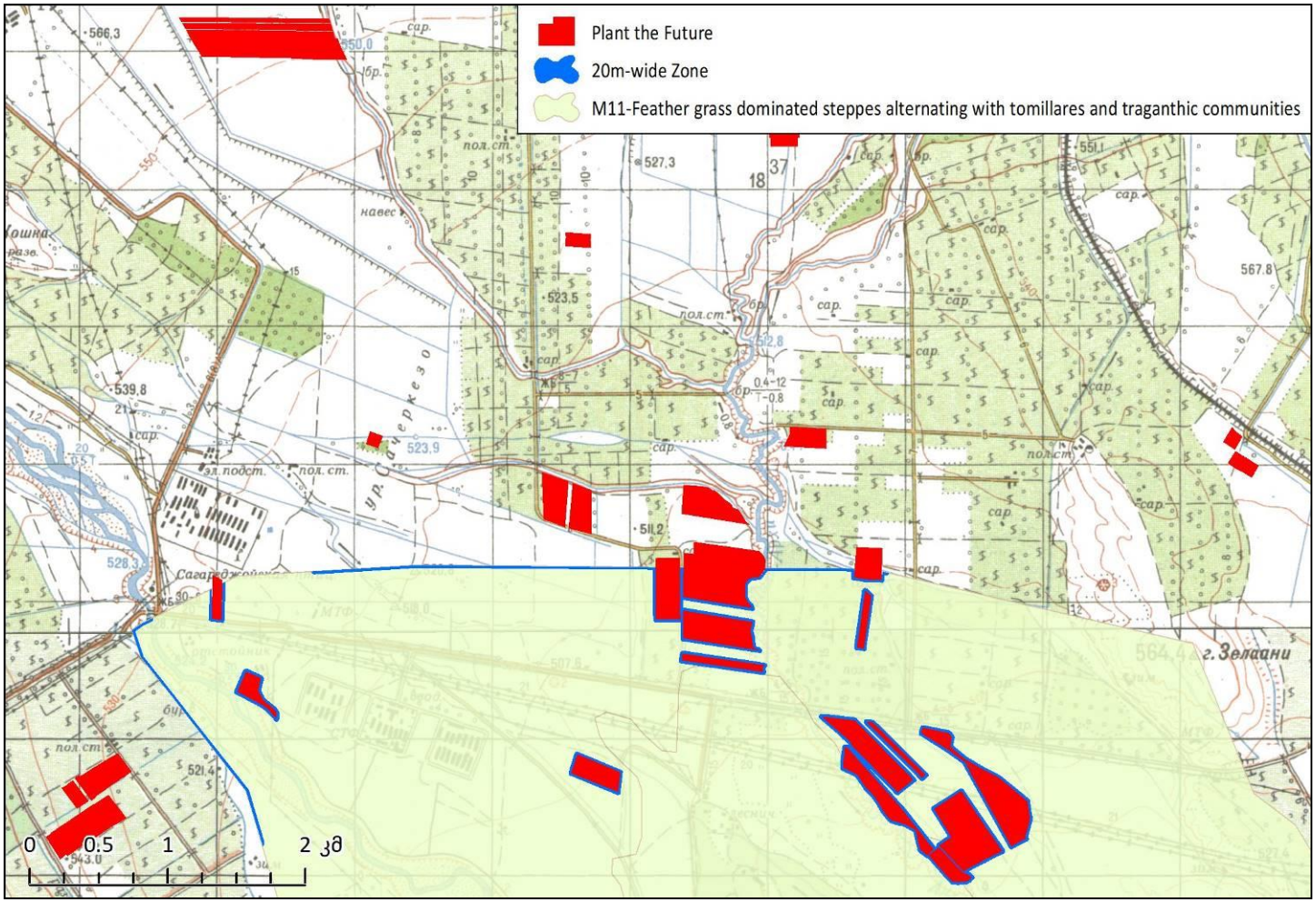
Map 1a Location of land parcels subsidized by "Plant the Future"



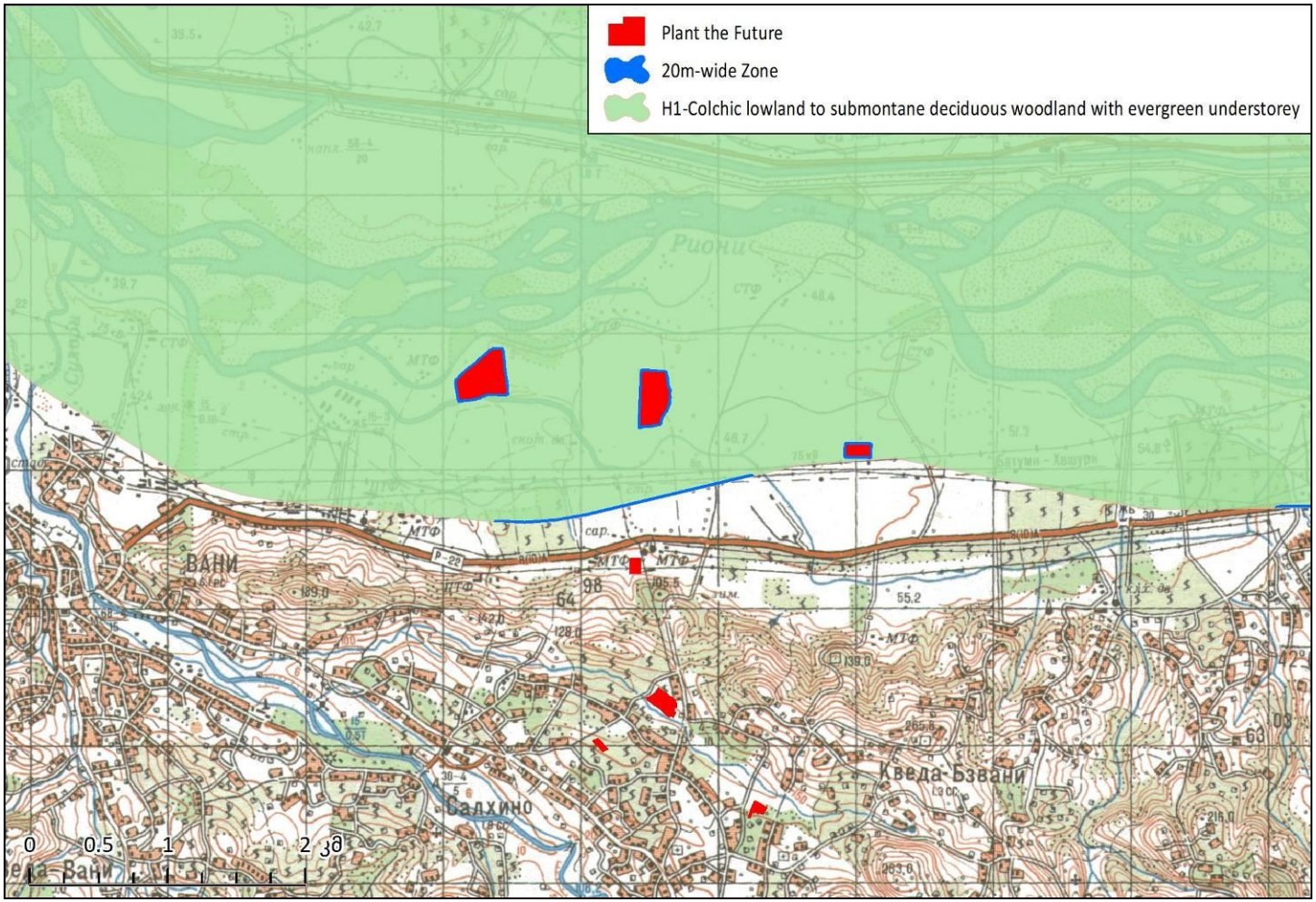
Map 1b Sensitive biodiversity receptors in areas of subsidized land parcels, “Plant the Future”



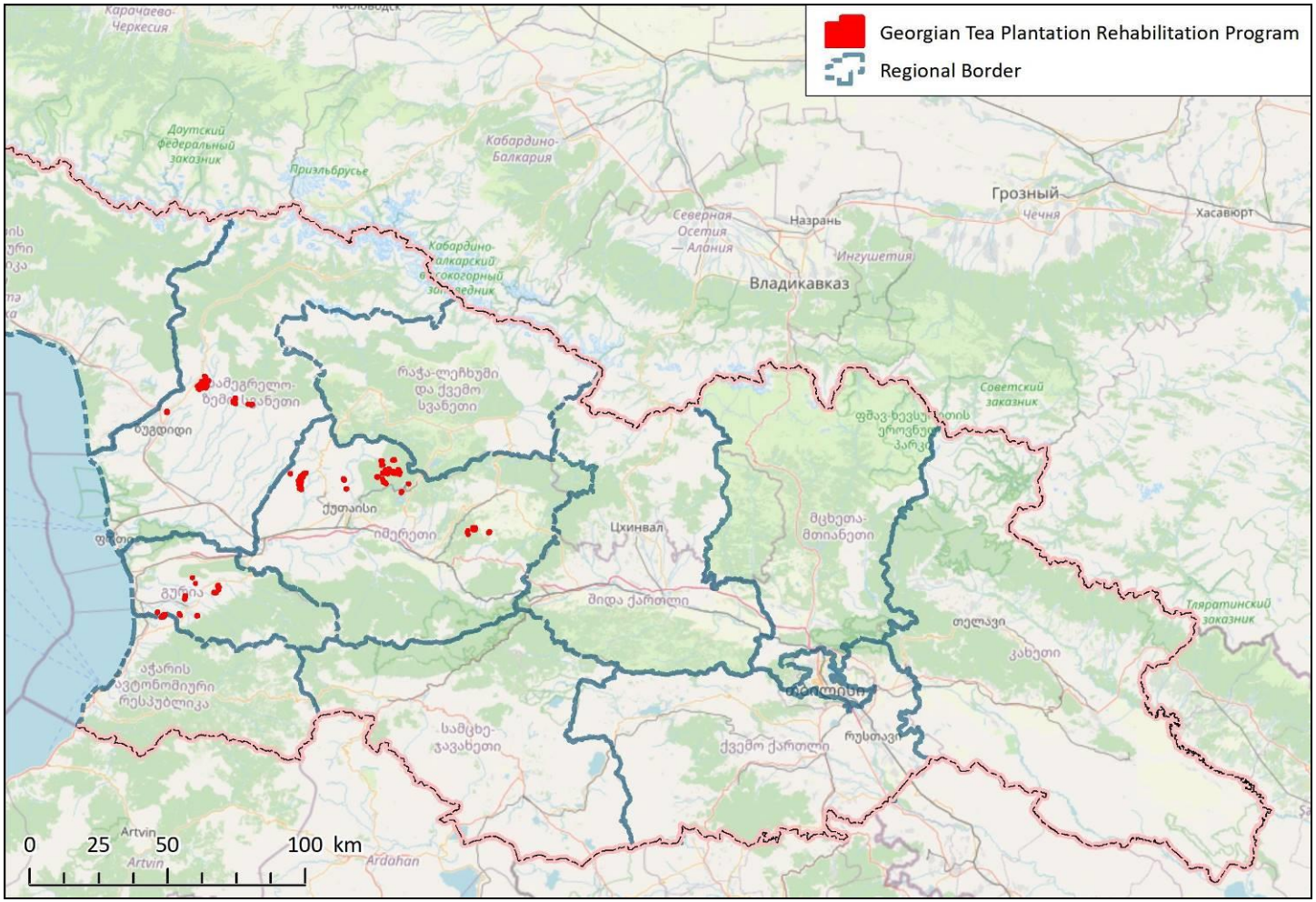
Map 1c Sensitive biodiversity receptors in areas of subsidized land parcels, "Plant the Future"



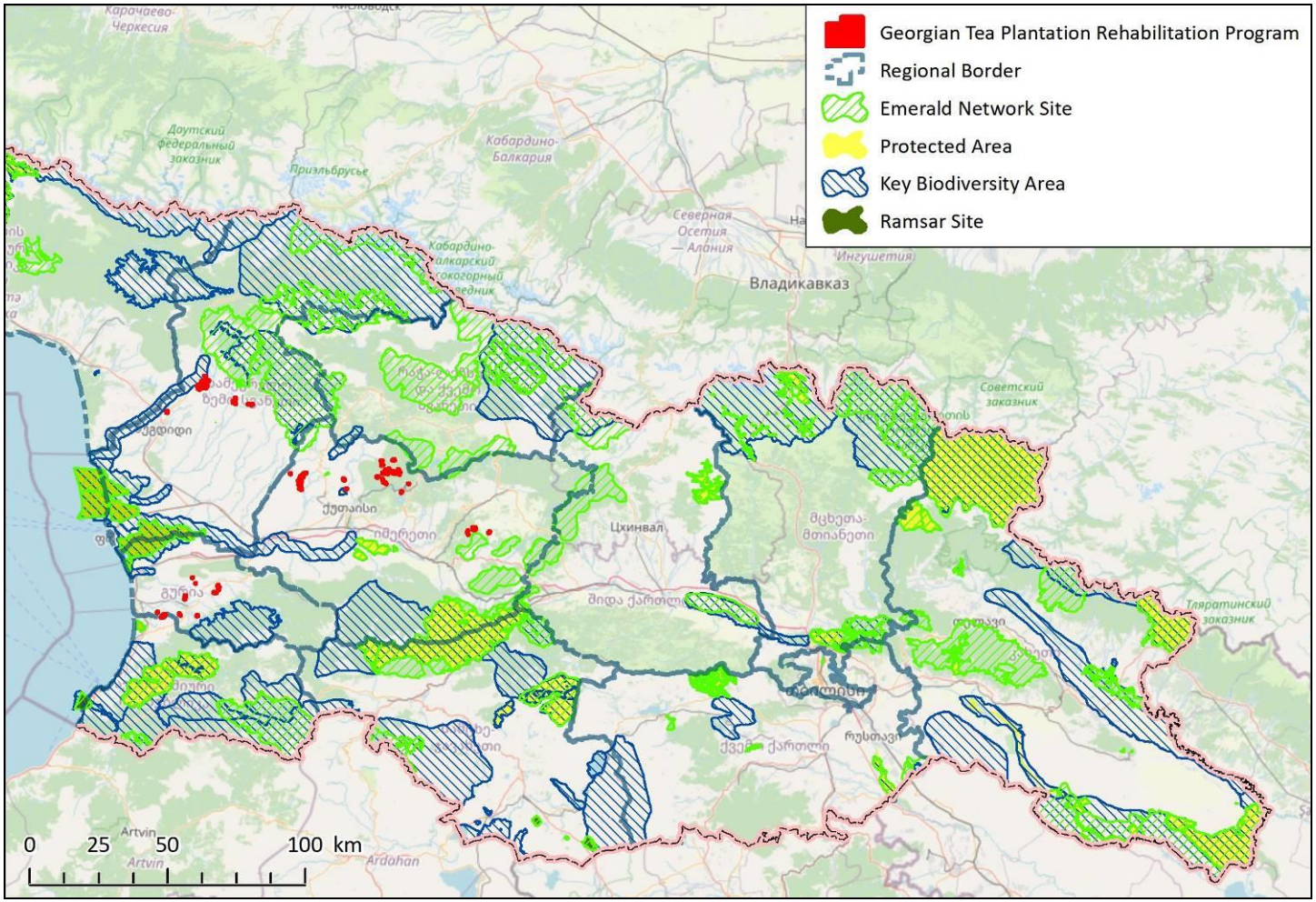
Map 1d **Subsidized land parcels and affected ecosystem in nearest sensitive biodiversity receptor, "Plant the Future"**



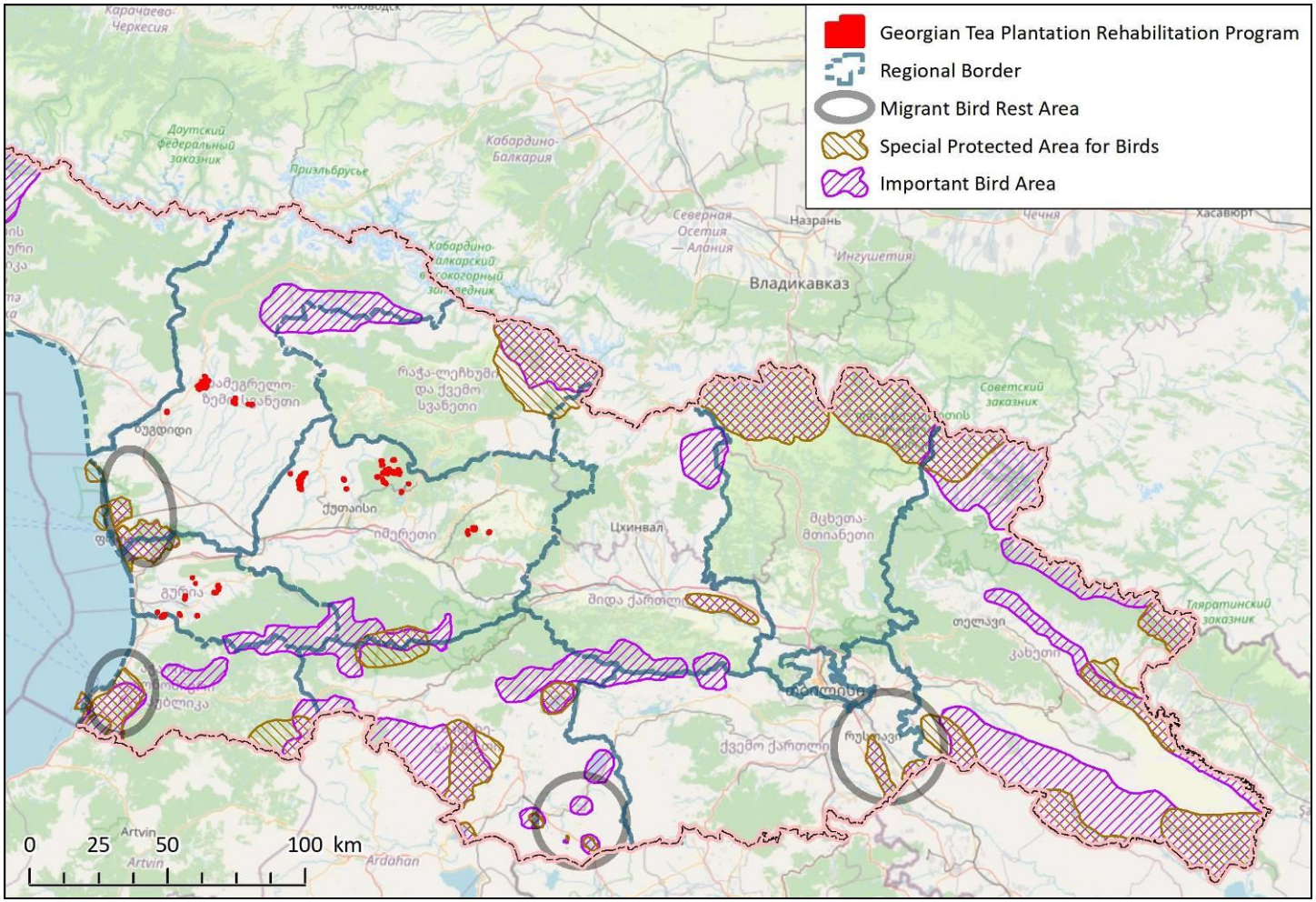
Map 1e Subsidized land parcels and affected ecosystem in nearest sensitive biodiversity receptor, "Plant the Future"



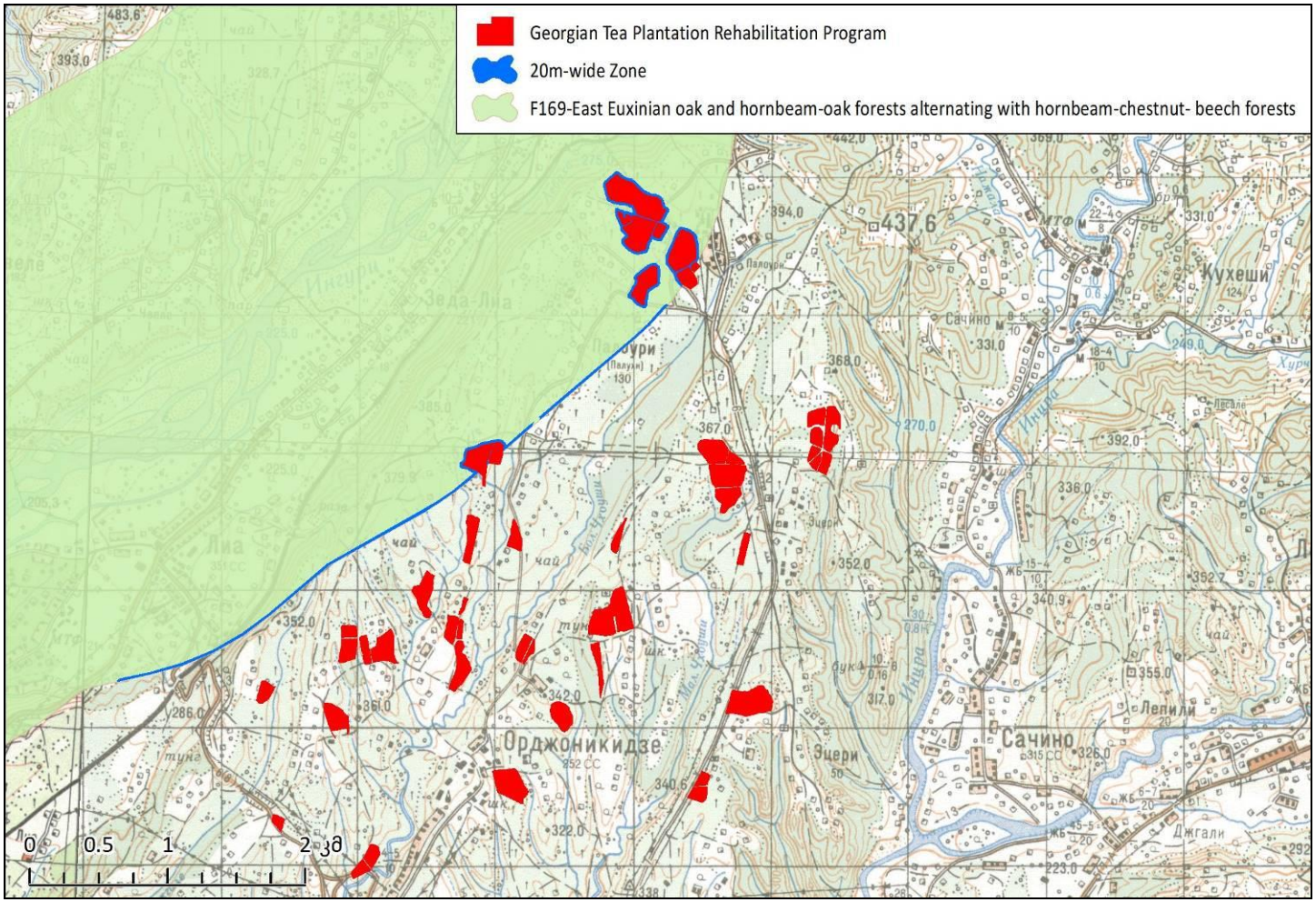
Map 2a Location of land parcels subsidized by Georgian Tea Plantation Rehabilitation Program



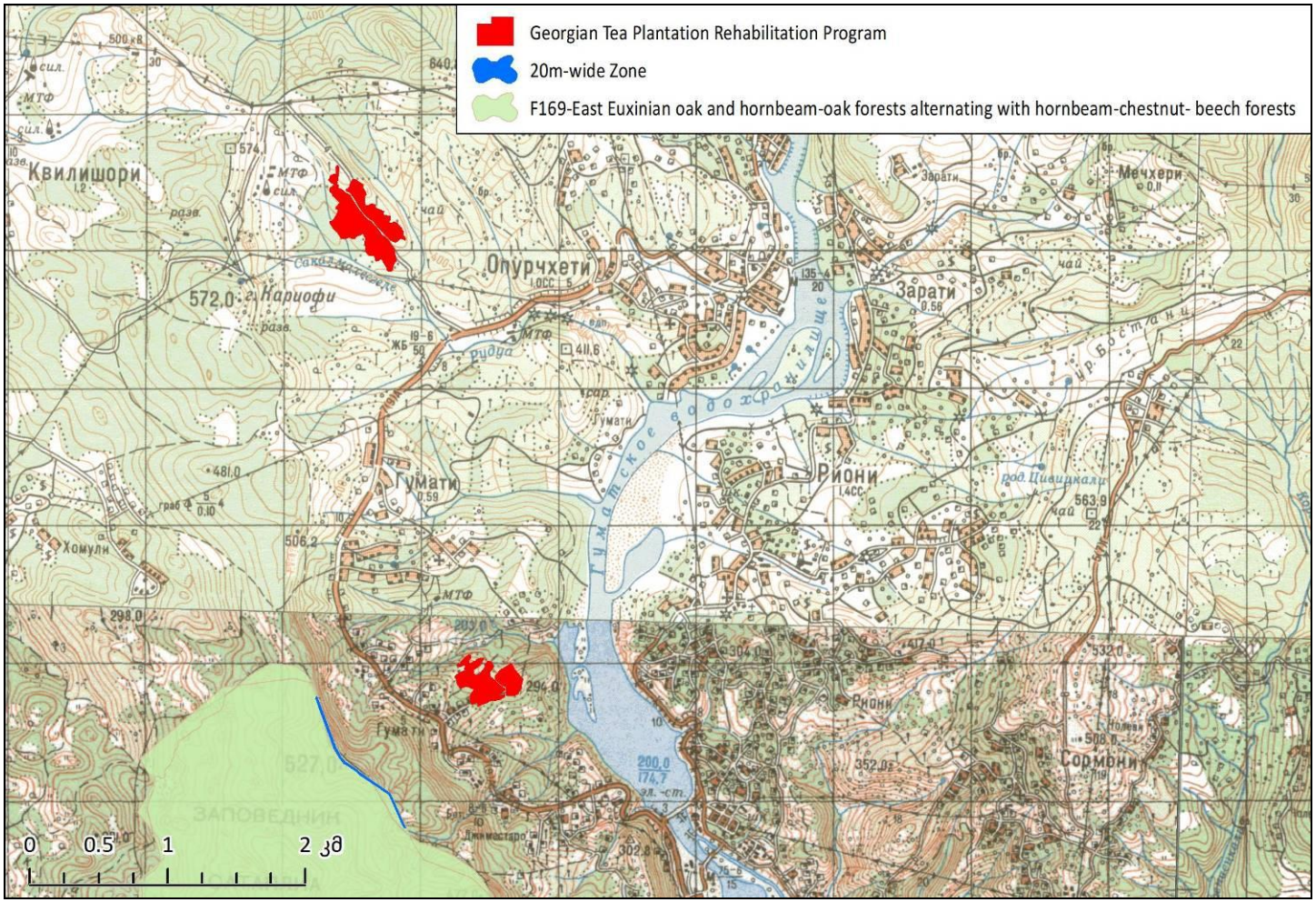
Map 2b **Sensitive biodiversity receptors in areas of subsidized land parcels, Georgian Tea Plantation Rehabilitation Program**



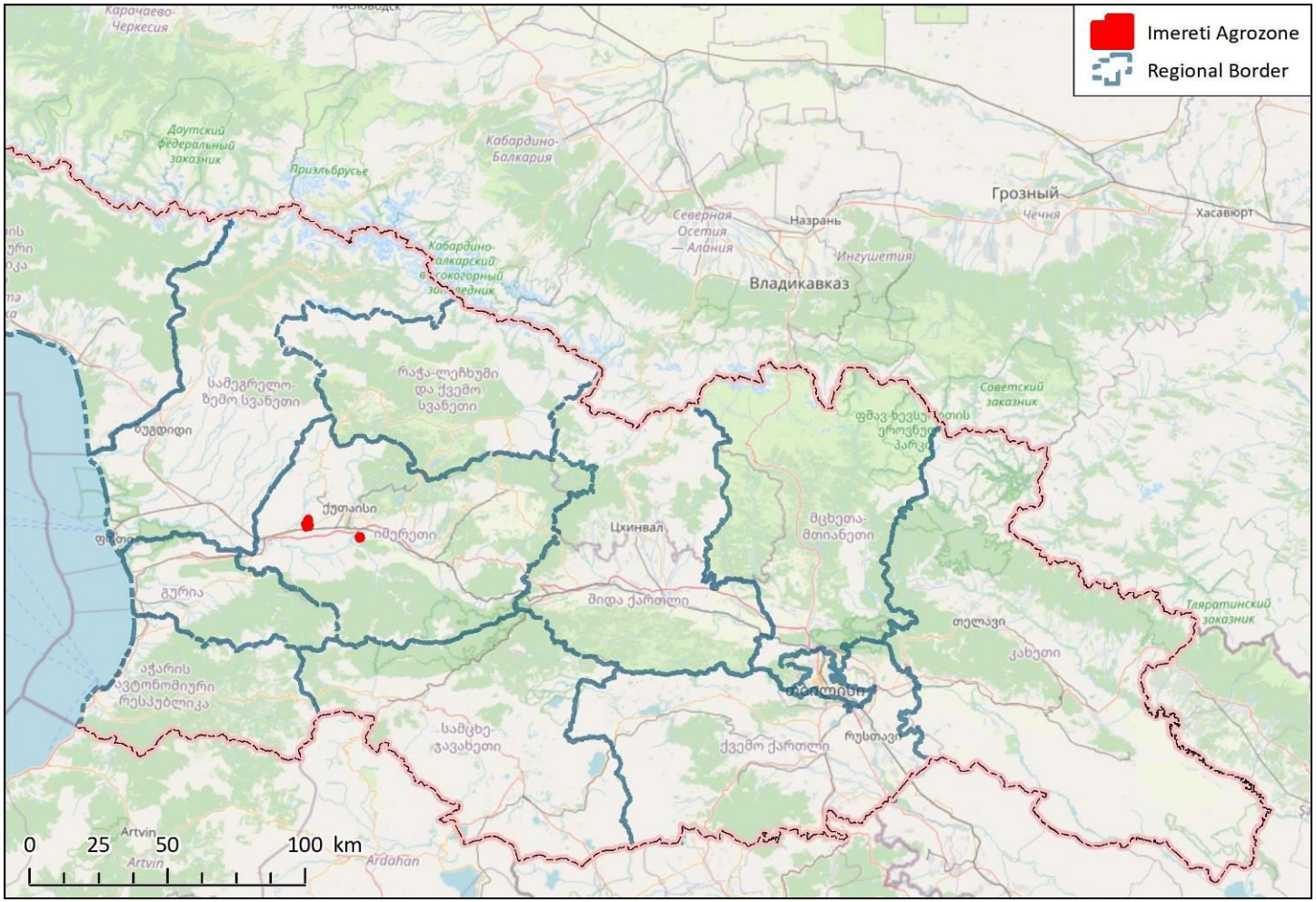
Map 2c **Sensitive biodiversity receptors in areas of subsidized land parcels, Georgian Tea Plantation Rehabilitation Program**



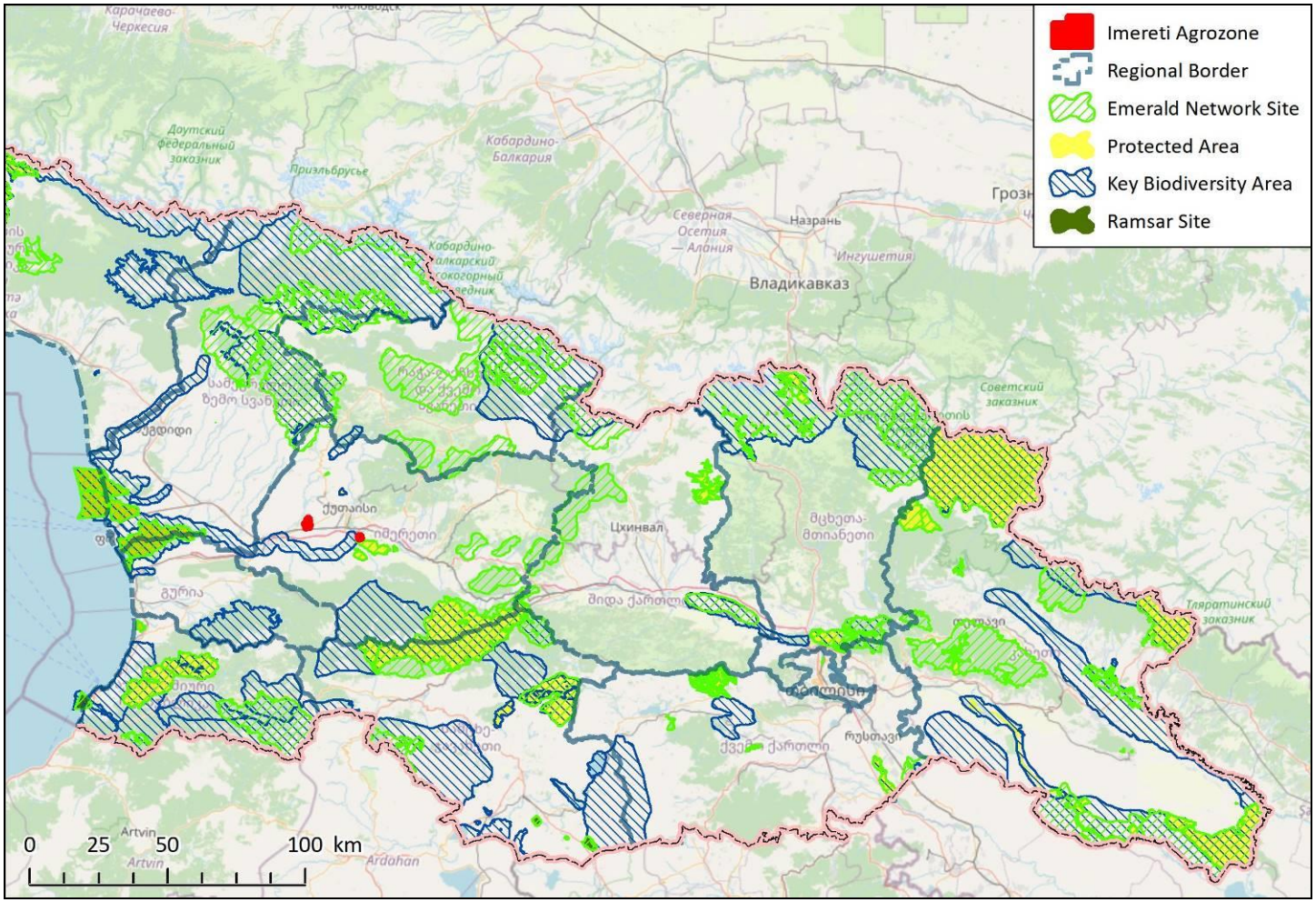
Map 2d **Subsidized land parcels and affected ecosystem in nearest sensitive biodiversity receptor, Georgian Tea Plantation Rehabilitation Program**



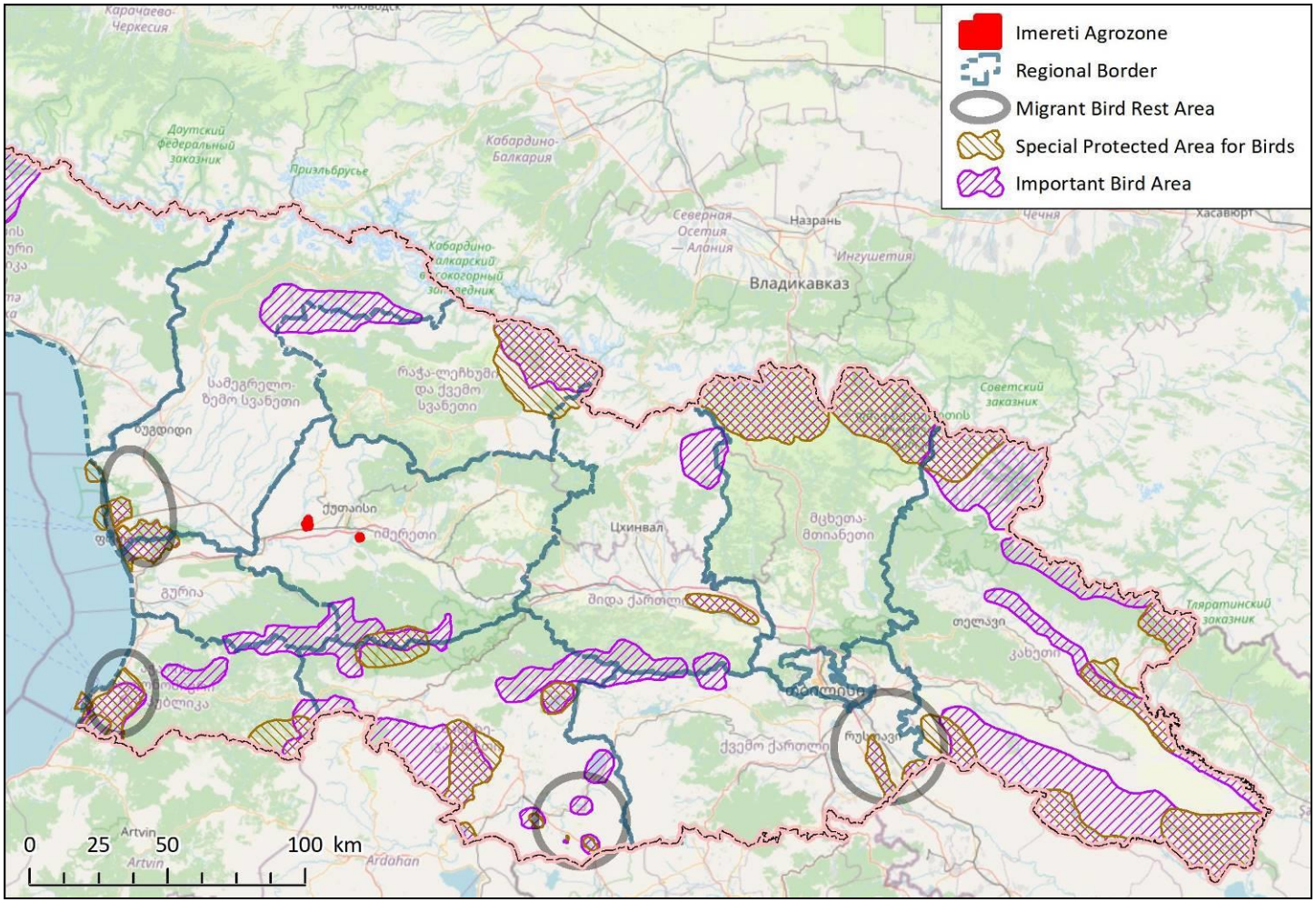
Map 2e **Subsidized land parcels and affected ecosystem in nearest sensitive biodiversity receptor, Georgian Tea Plantation Rehabilitation Program**



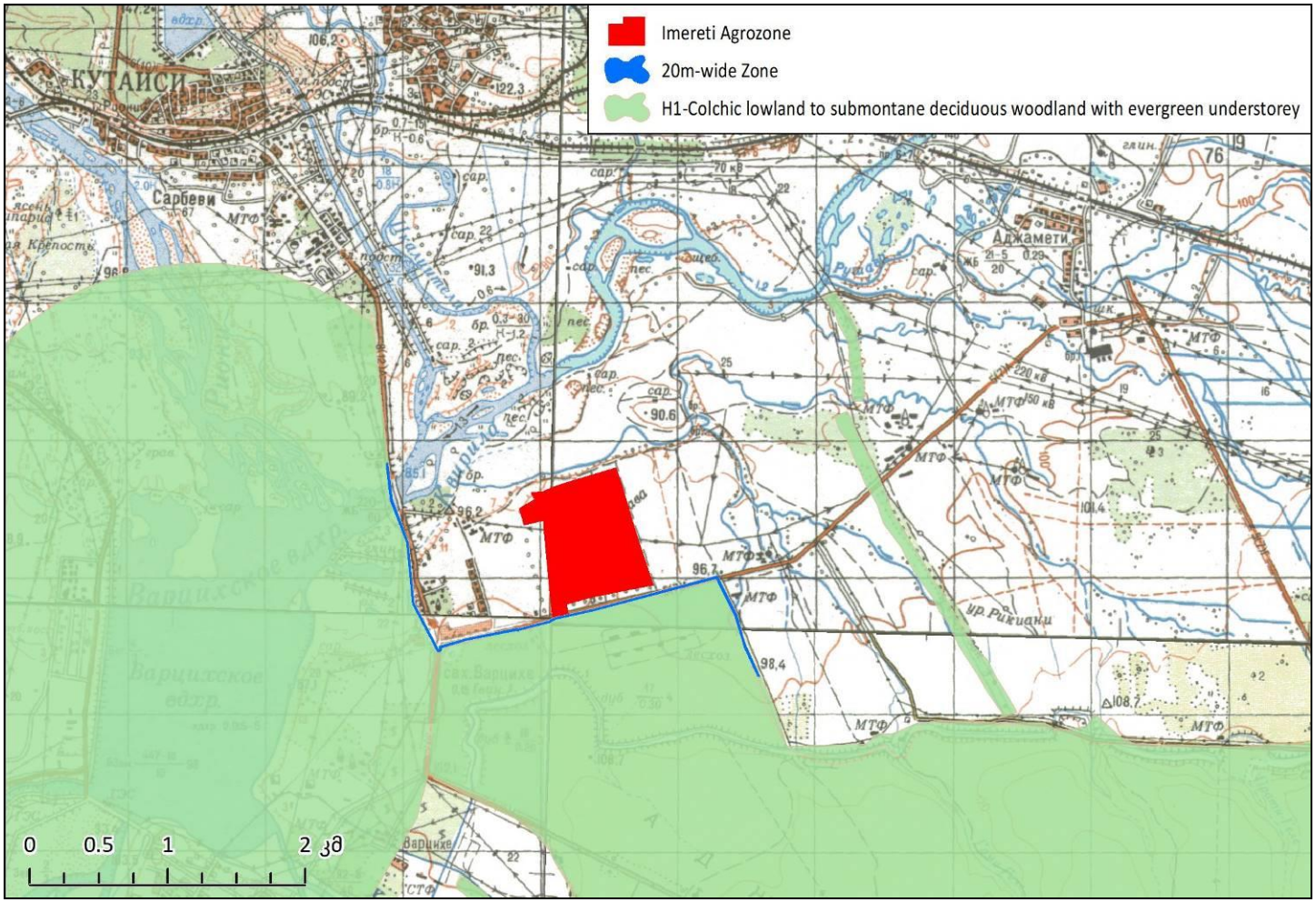
Map 3a Location of land parcels subsidized by Imereti Agrozone



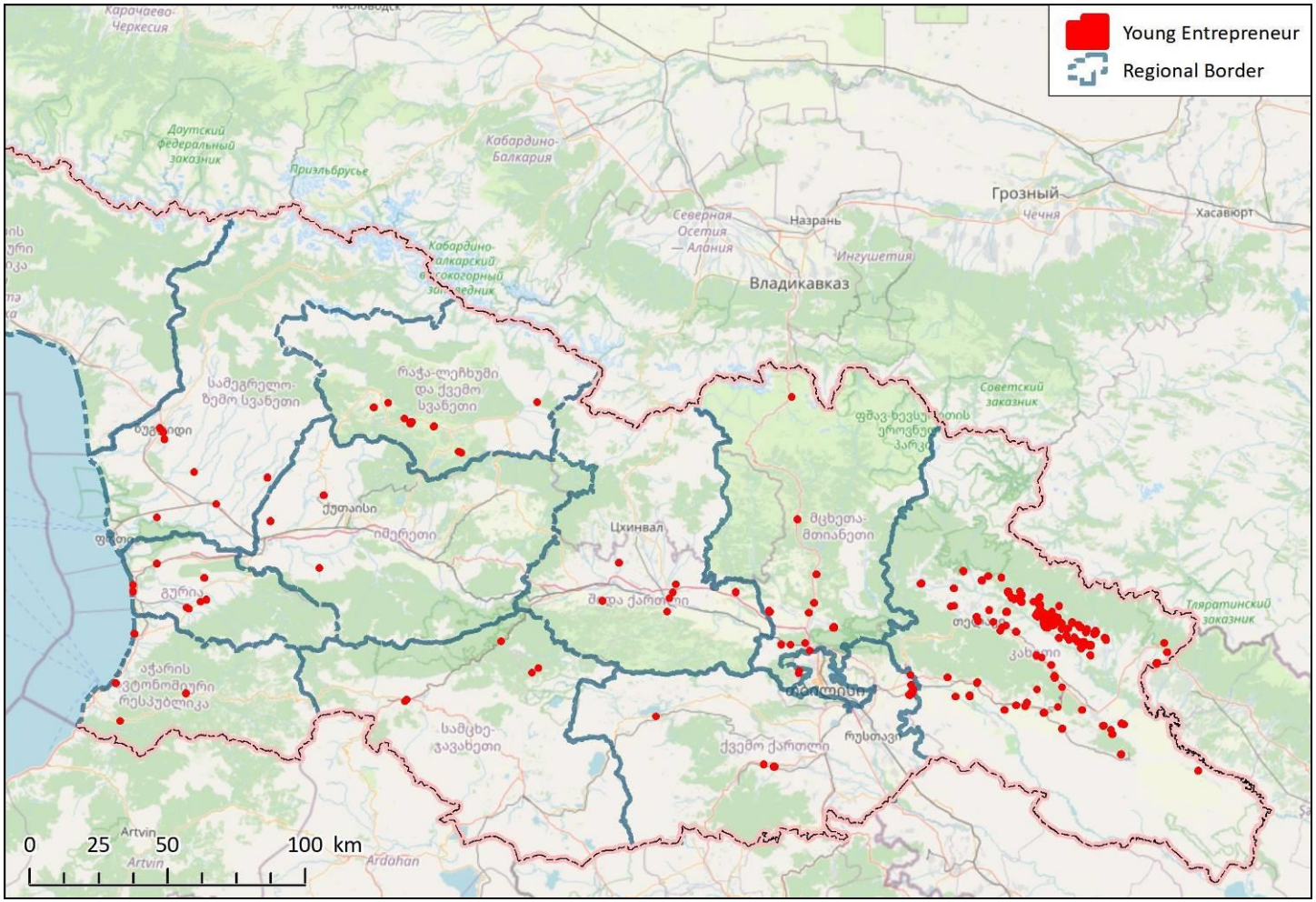
Map 3b Sensitive biodiversity receptors in areas of subsidized land parcels, Imereti Agrozone



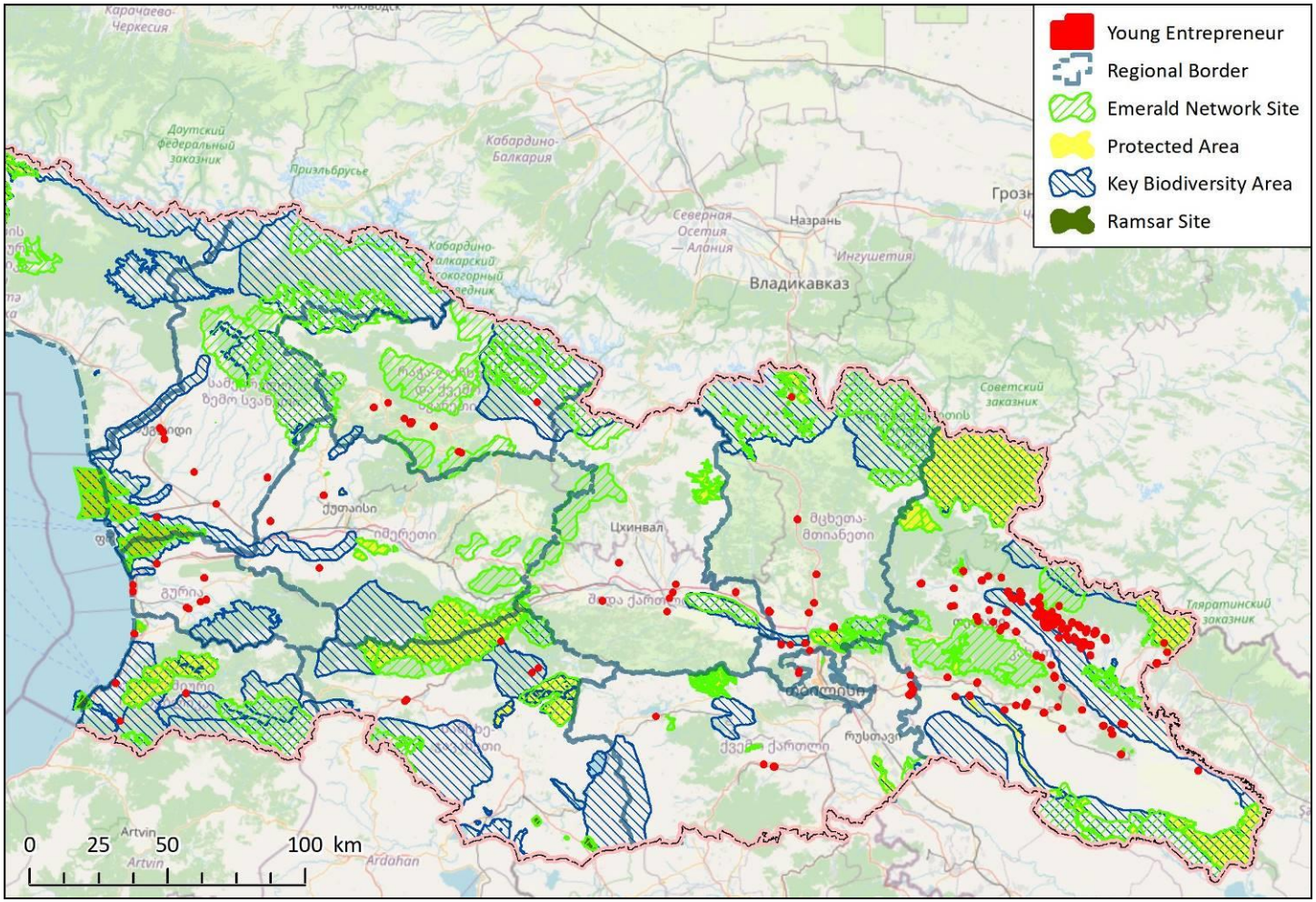
Map 3c Sensitive biodiversity receptors in areas of subsidized land parcels, Imereti Agrozone



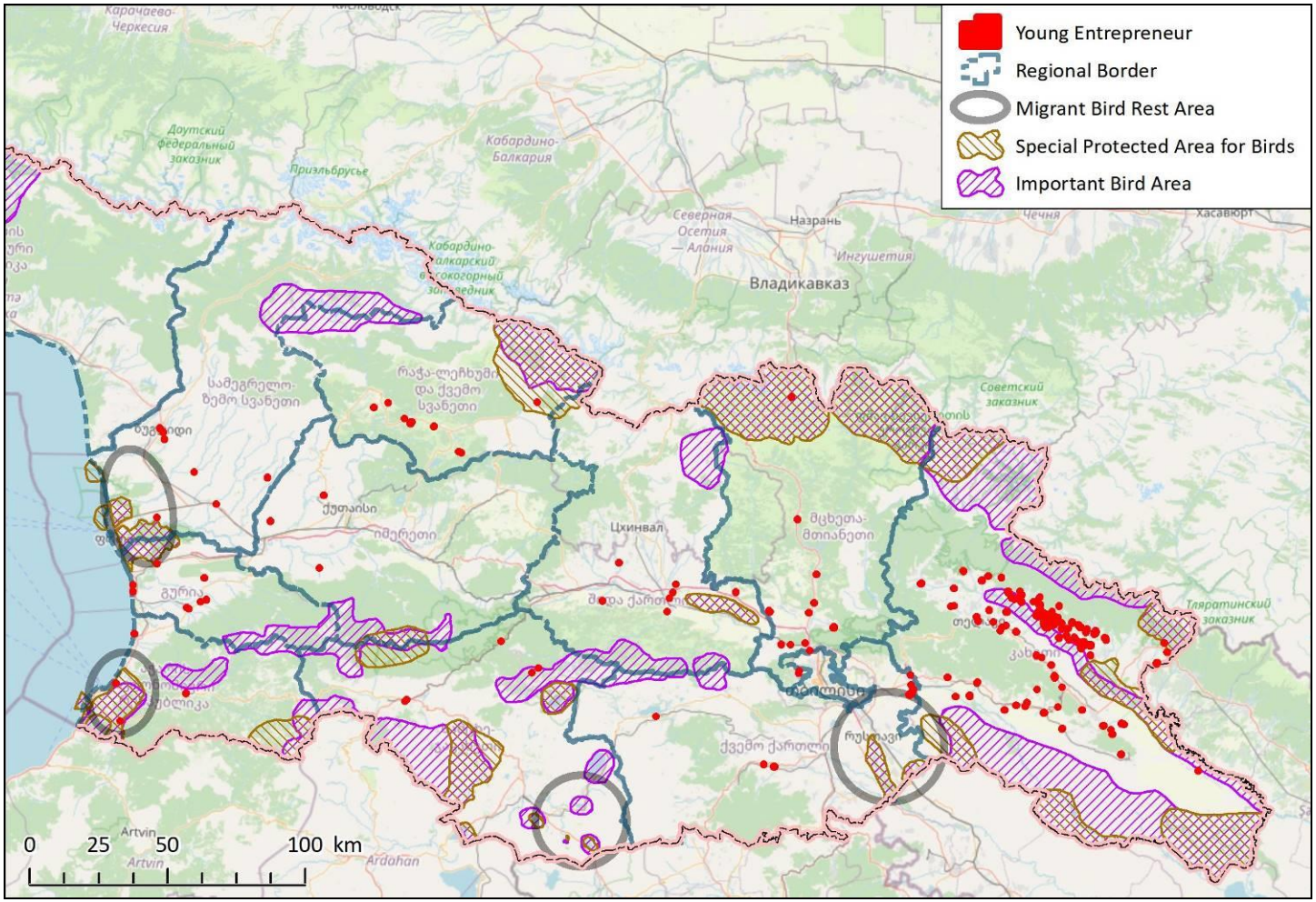
Map 3d **Subsidized land parcels and affected ecosystem in nearest sensitive biodiversity receptor, Imereti Agrozone**



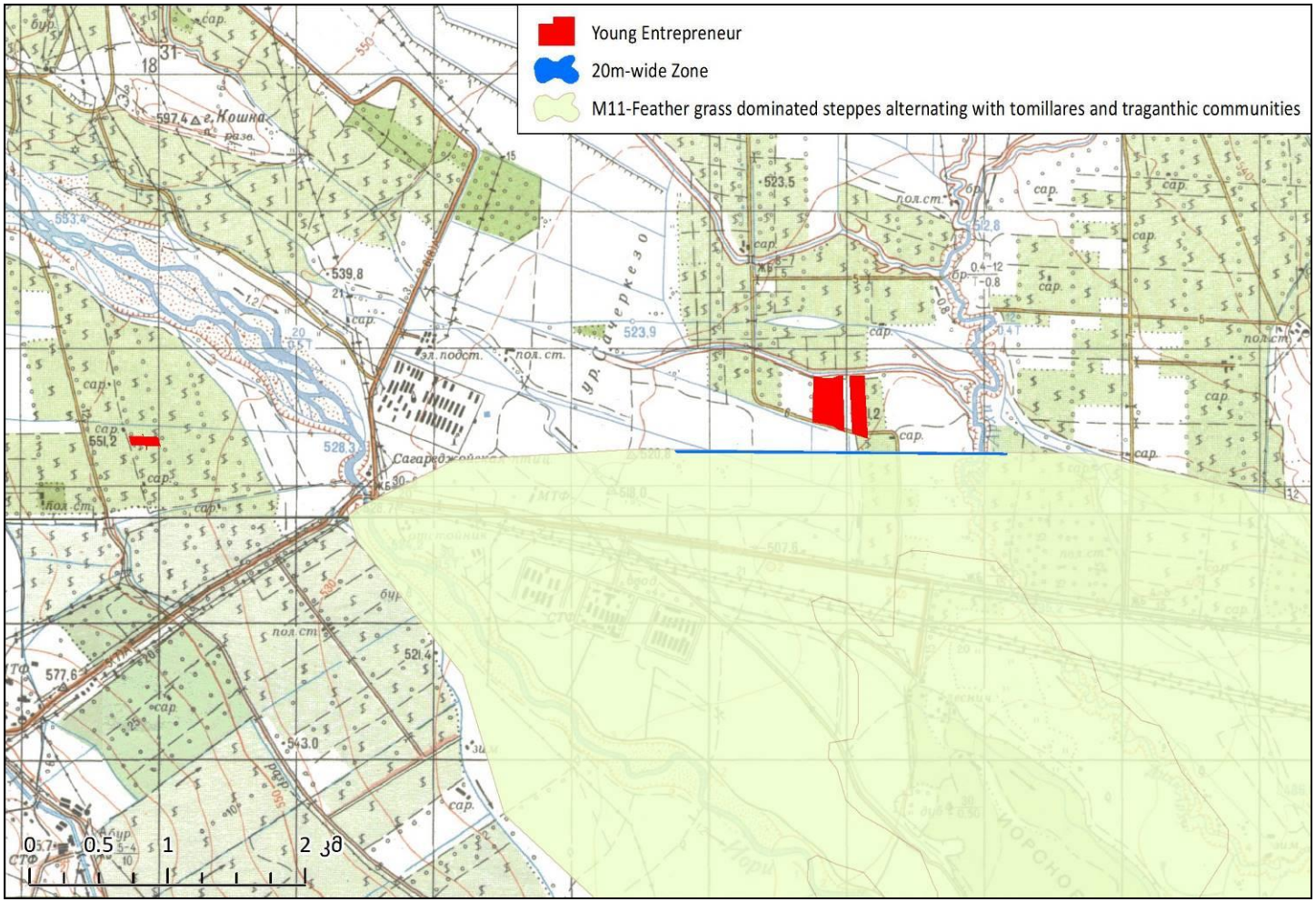
Map 4a Location of land parcels subsidized by Young Entrepreneur



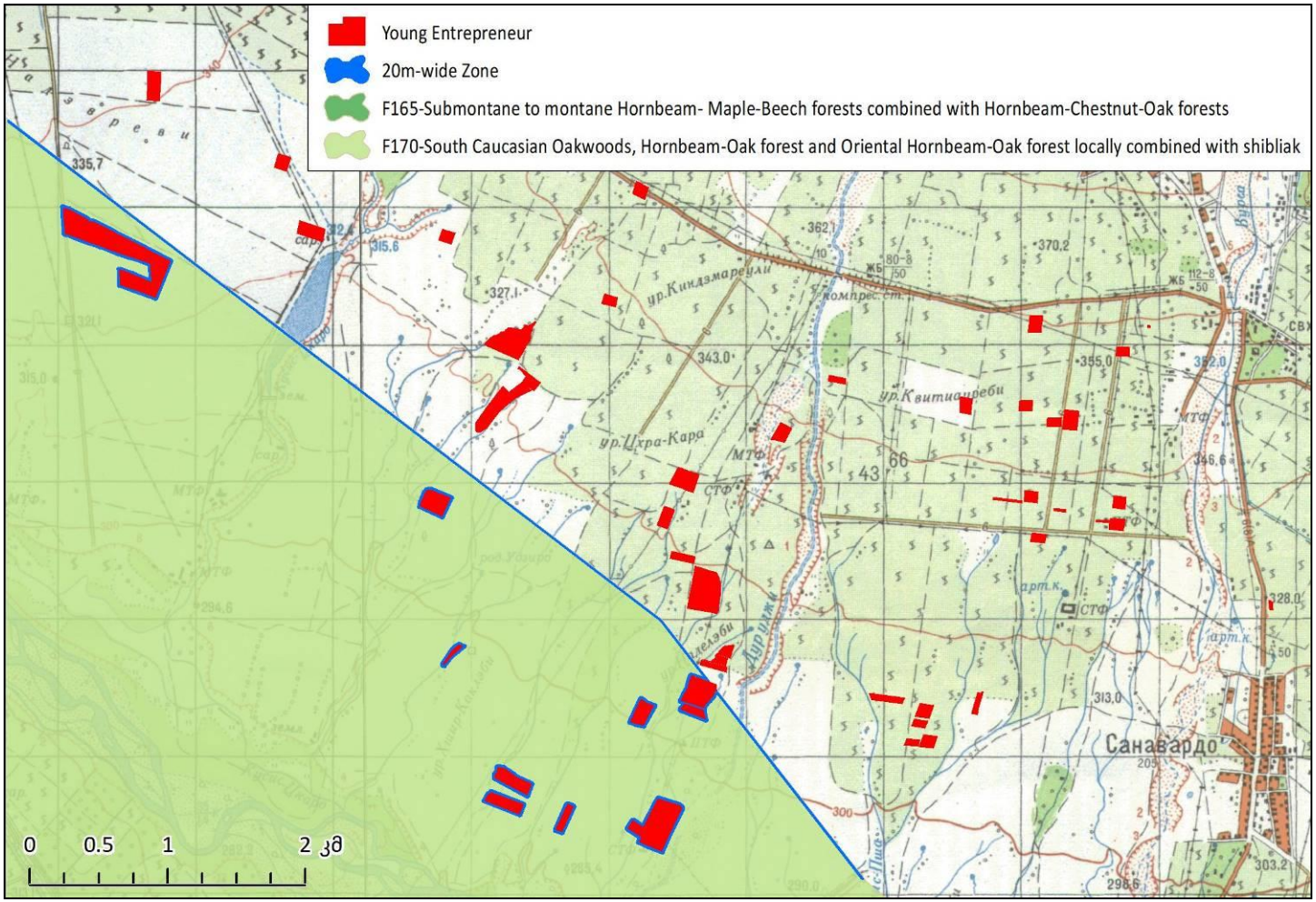
Map 4b Sensitive biodiversity receptors in areas of subsidized land parcels, Young Entrepreneur



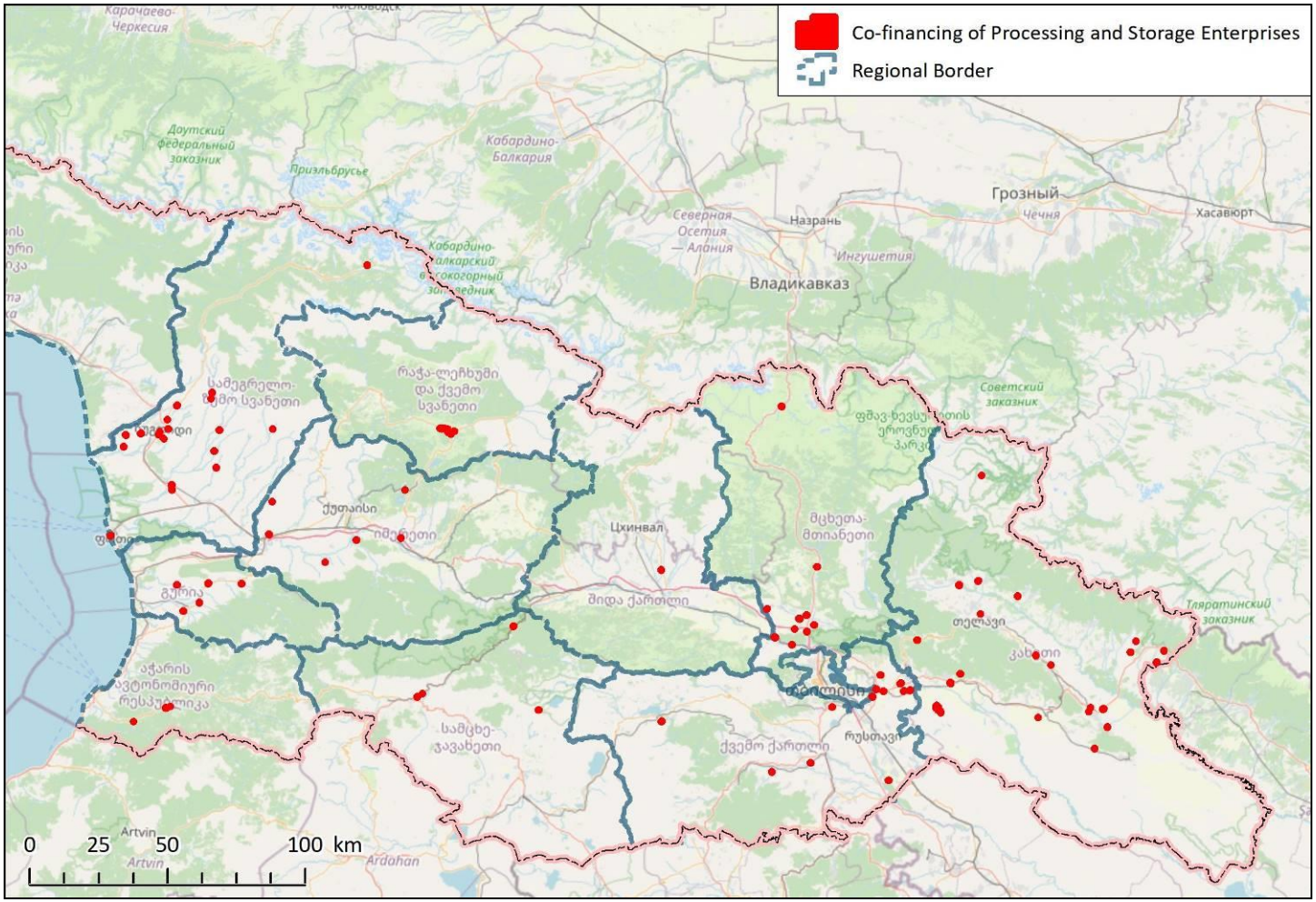
Map 4c Sensitive biodiversity receptors in areas of subsidized land parcels, Young Entrepreneur



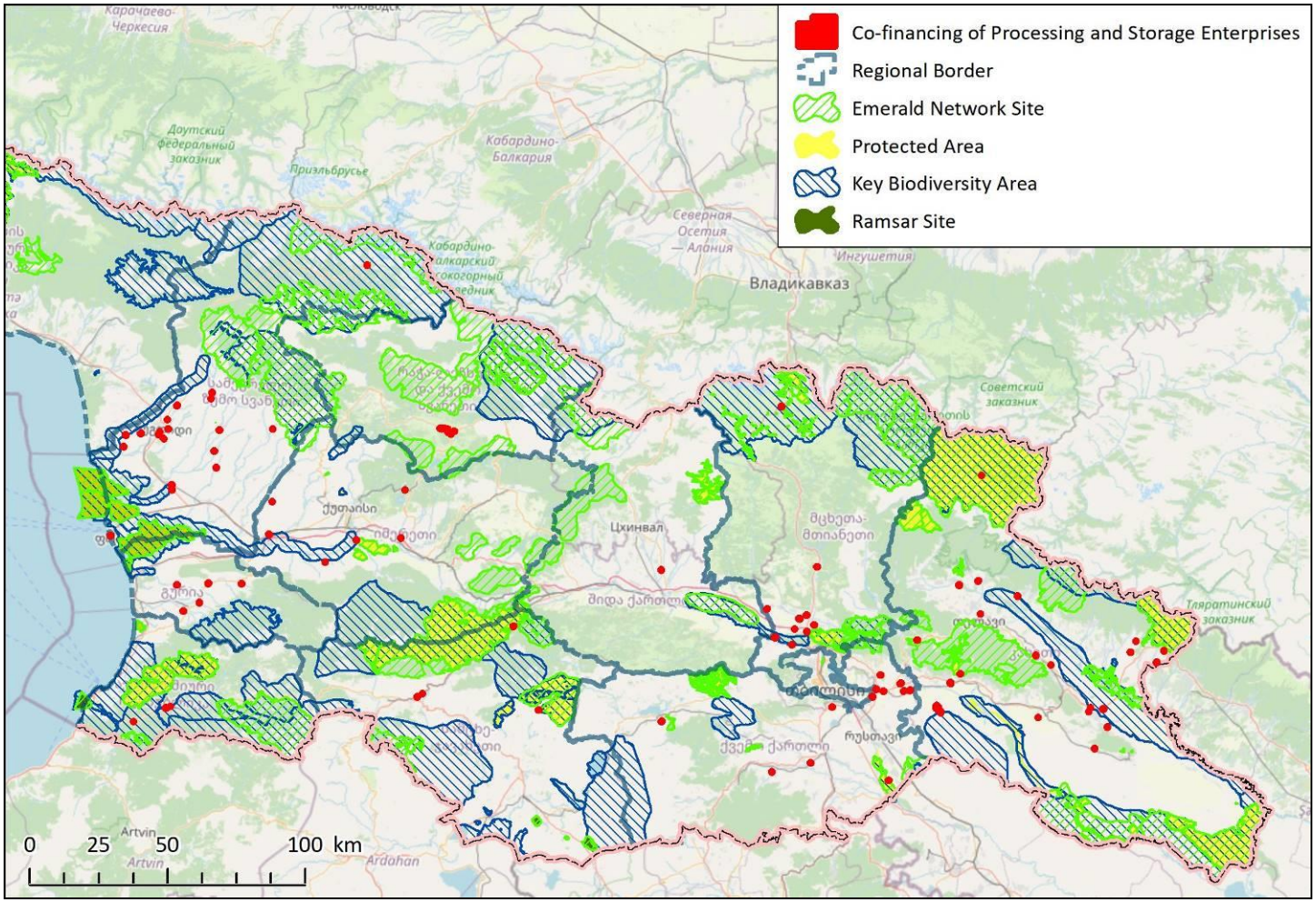
Map 4d **Subsidized land parcels and affected ecosystem in nearest sensitive biodiversity receptor, Young Entrepreneur**



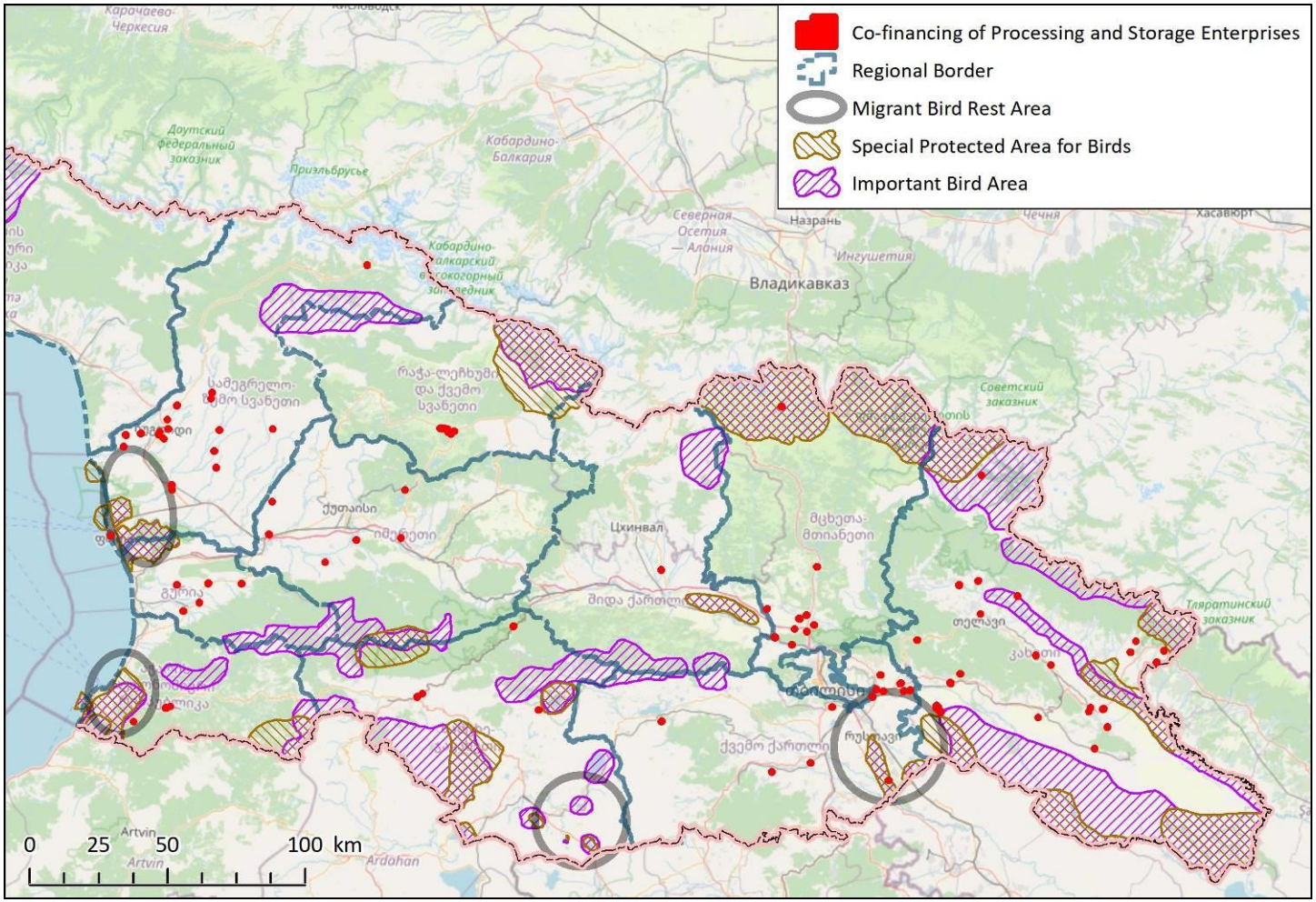
Map 4e Subsidized land parcels and affected ecosystem in nearest sensitive biodiversity receptor, Young Entrepreneur



Map 5a Location of land parcels subsidized by Co-financing of Processing and Storage Enterprises



Map 5b **Sensitive biodiversity receptors in areas of subsidized land parcels, Co-financing of Processing and Storage Enterprises**



Map 5c **Sensitive biodiversity receptors in areas of subsidized land parcels, Co-financing of Processing and Storage Enterprises**