*The Economic Evaluation of the Pastureland of the Kyrgyz Republic*

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**Abstract**
This paper estimates the economic value of the pastureland in the Kyrgyz Republic. The agriculture sector of the Kyrgyz Republic, especially livestock grazing, faces a challenge of pasture overgrazing and the declining productivity of the pastureland. Heeding on the sustainability policy of the Kyrgyz Republic, this study tries to find out if it is possible to better estimate the value of the pastureland as natural capital and quantifying its economic benefits, given limited data on the natural environment in the Republic. This research examines the applicability of the System of Environmental-Economic Accounting (SEEA) methodologies, a newly developed United Nations initiative. It first examines different methods of the SEEA and how the pastureland accounting, which has not been done yet previously, can possibly help estimate the environmental stock and flows of the natural capital. It further analyzes the ecological consequences and benefits.

Keywords: Natural capital, System of Environmental-Economic Accounting, Ecosystem accounting, Overgrazing

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## 1 Introduction

In 2012, the UN Statistical Commission adopted the System of Environmental-Economic Accounting-Central Framework (SEEA-CF) to aid countries to statistically describe the interactions between the economy and the environment by linking indicators of national accounts with environmental factors. This new system basically incorporates physical natural assets, and records physical quantities of natural inputs to the economy. It identifies residuals produced and consumed (and by whom) as well as changes in private and public natural assets. SEEA account structures are closely aligned with those of national statistical frameworks. This makes the linking to national accounts possible. One year later, the UN also released another version, the SEEA Experimental Ecosystem Accounting (SEEA-EEA) to complement the Central Framework (UN et al., 2014).

More than 55 countries initially expressed interests in this accounting system, including the Kyrgyz Republic, where overgrazing and deforestation have led to the disappearance of important pasture plants, plant resources, and soil erosion. About 29% of pasturelands were at a middle and high level of degradation (Penkina, 2014). The summer pasture yield decreased from 8.6 dt dry matter (DM)/ha in the early 1970s to, 5.7 dt DM/ha in the 1990s, and 3.1 dt DM/ha in 2004. In the last 50 years the yields from summer and winter pasturelands have decreased by about three times. This means that about 11.5 million tons of natural forage was lost annually (MoA, 2012).

In order to fully understand what this decline means for Kyrgyz Republic decision-makers, this paper argues that the System of Environmental-Economic Accounting (SEEA) can be a useful tool for the pastureland capital valuation. The SEEA also can be applied to the Kyrgyzstan's System of National Accounting (SNA) to produce a set of microeconomic indicators, which is a common tool for decision makers.

## 2 Research Objective

The pastureland is one of the most important natural capital for the Kyrgyz Republic, and it is imperative to estimate its values. The objective of this research, therefore, is to examine the soundness of the SEEA in doing so. As the SEEA is relatively new tool with limited published results, the following discussion first introduces the past relevant results from Australia. Then we discuss how the value of the pastureland in the Kyrgyz Republic can be better captured by using two major methods of the SEEA.

## 3 Cases of SEEA implementation

### 3.1 Australian Land SEEA

In order to find out if the SEEA can be a useful tool for numerically describing pastureland benefits in the Kyrgyz Republic, it is important to find out how it has been used by some countries. Then we can better grasp the potential benefits arising from this statistical framework for better policy options. One of the advanced SEEA applications has been observed in Australia. This country is similar to the Kyrgyz Republic to some extent as it emphasizes pastureland and livestock grazing. Using the SEEA, the Australian Bureau of Statistics estimated that the total value of natural capital in Australia was AU$ 5.836 billion, of which the land had the greatest value at 81% or AU$ 4.722 billion in 2015 (ABS, 2017)

So far, no SEEA focused only on pastureland. The closest available results are land accounts that measure integrated features of land, and describe how these features can be changed over time. Land accounts inform decision-makers for land management and the sustainable production of goods and services (ABS, 2011). They can also inform the public about the productive capacity of land across different industries, and the impact of different land management decisions on the carbon cycle and water availability.

Australia's land accounts in the SEEA Central Framework (SEEA-CF) focused on the Flinders–Norman rivers catchment in northern Queensland. Three types of output reports were presented: a basic stock table, a change (flow) matrix, and a change (flow) map. For the land cover classification it adopted the international standard called the Land Cover Classification System (LCCS), which was developed by the United Nations Food and Agriculture Organization. The classification was done on the basis of primarily non-vegetated land and primarily vegetated land. The latter lands are further divided into different categories based on vegetation (Bureau of Meteorology, 2013: 122).

### 3.2 Fast-tracking Forest Accounts in the Kyrgyz Republic

The Kyrgyz Republic is one of the pilot project countries for the SEEA. Partly to deal with overgrazing and deforestation, the Kyrgyz government established a national sustainability strategy and entrusted the Ministry of Economy to undertake this policy. Efforts for "green growth" are under way with the establishment of green growth indicators.

In 2015, the National Statistics Committee of the Republic made the first attempt to make SEEA Experimental Ecosystem Accounts (SEEA-EEA) for forest provisioning services. Whereas the Central Framework focuses on the economic units and incorporates environmental inputs, the Experimental Ecosystem Accounts focuses on ecosystem aspects and attempts to connect them to economic units. Since 93% of the country's area is mountainous, the Kyrgyz Republic needed the forest-based or ecology-based accounting system to reduce natural disasters like landslides.

The results highlighted the previously ignored contribution of forests to Kyrgyzstan's gross domestic product (GDP). When the value of non-timber forest products are included in GDP, the contribution of forest products increases by 25 times from 0.05% to 1.24%. These experimental environmental accounts provide the basic guideline to improve and integrate with official data flows to the SNA of the Kyrgyz Republic (NSC, 2016).

## 4 Using Environmental Accounts

### 4.1 The Ecosystem Model Concept

The SEEA-EEA the Kyrgyz Republic used for forest accounts consists of five main components (Figure 1). The first component is the ecosystem asset in a spatial area. Different types of ecosystem assets exist within a territory. Second, every single ecosystem asset contains a set of relevant (2) ecosystem characteristics and processes. This implies ecosystem functions. This means “the stock and changes in stock of ecosystem assets is measured by assessing the ecosystem asset’s extent and condition using indicators of the relevant ecosystem asset’s area, characteristics and processes” (UN, 2017). Third, each ecosystem asset provides a set of (3) ecosystem services. Fourth, the ecosystem services contribute to (4) the production of benefits. Benefits are represented by goods or services (products) the SNA (e.g. timber products) recognizes. The SNA terms those that are not produced by economic units (e.g. clean air) non-SNA benefits. Finally, both SNA and non-SNA benefits contribute to (5) individual and societal well-being (UN, 2017).

Marketable ecosystem goods and services are considered in market transactions of ecosystem assets, but non-market ecosystem services (e.g., soil carbon sequestration) are not generally be considered by the buyer or seller of an ecosystem asset (Hein et al., 2016). The concept of ecosystem capacity can be directly linked to the measurement of ecosystem degradation (UN, 2017).

From an accounting perspective, the ecosystem capacity measurement is based on the link between ecosystem capacity and ecosystem degradation (UN, 2017). In the SEEA-EEA, ecosystem degradation is defined in relation to the decline of an ecosystem asset condition that is affected by human activities (UN, et al., 2014)

The UN Technical Recommendations for the SEEA-EEA (UN, 2017) offers four main approaches to measure degradation: (1) in physical terms through changes in ecosystem condition indicators; (2) in monetary terms through changes in the net present value (NPV) of the actual use of ecosystems; and (3) in monetary terms through changes in NPV of capacity. Note that a fourth potential option is available: (4) through changes in the NPV of the potential supply. The fourth approach may require the attribution of monetary values (i.e. option values) to ecosystem services that are currently not used. The latter two approaches to define degradation are unlikely to be relevant for accounting.

The ecosystem contributes to the changes in wealth at the national level. This means the data from SNA accounts are important to integrate the information about ecosystem services, goods and asset.

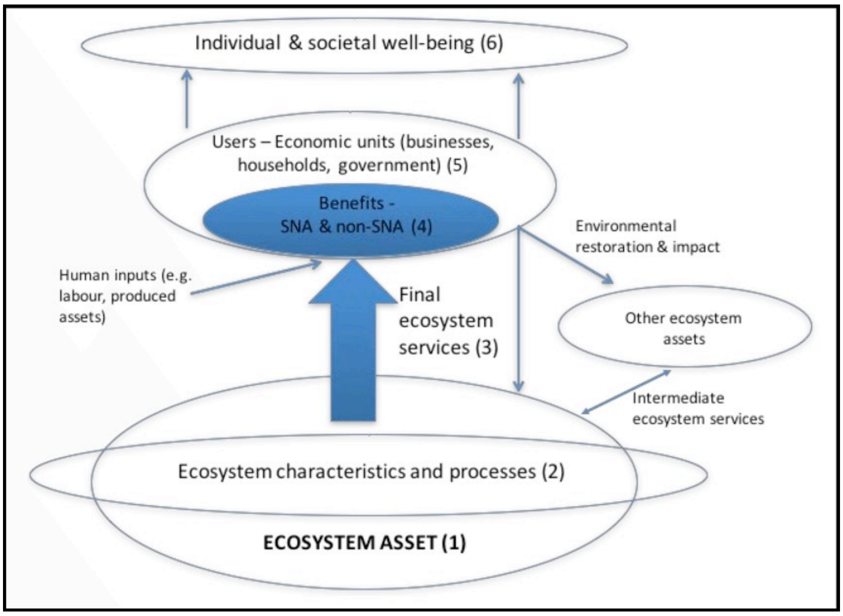


Figure 1: Ecosystem accounting framework (UN, 2017).

### 4.2 The classification of ecosystem services

The Common International Classification of Ecosystem Services (CICES) has emerged during the drafting work on the SEEA-EEA. For accounting purposes, the CICES distinguished three main types of ecosystem services: provisioning, regulating and cultural services. The CICES emphasized those services that have direct implications to humans (UNSD, 2016)

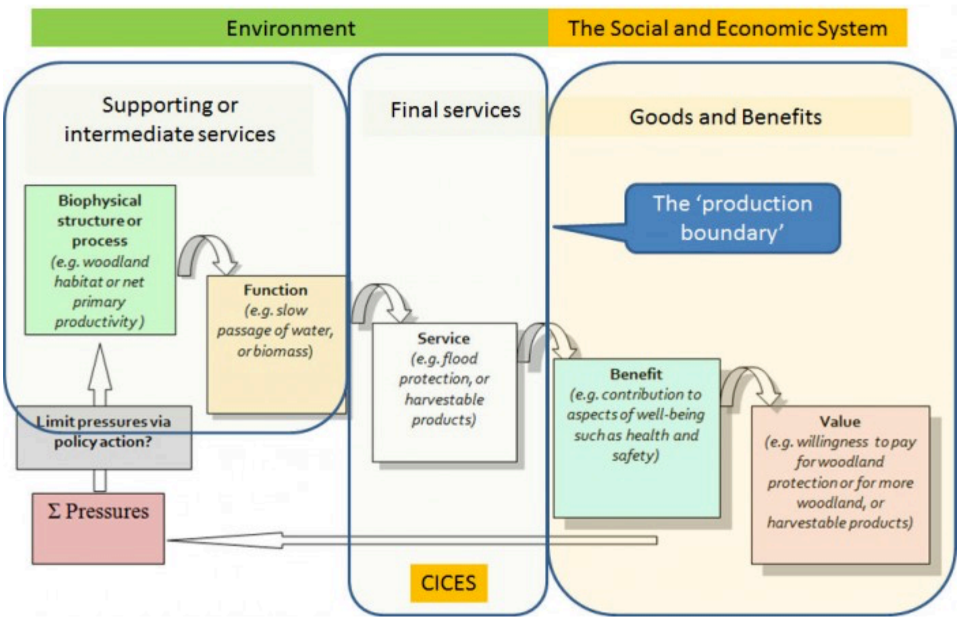


Figure 2: Common international classification of ecosystem services (UN et al., 2014)

### 4.3 The attempt to develop pastureland SEEA-EEA for the Kyrgyz Republic

Although the development of any ecosystem account requires large human capacity for data collection, analysis and technological resources, the SEEA can provide more focused valuation. (1) It can focus on a single ecosystem asset, ecosystem type, or ecosystem service. (2) It may combine a single ecosystem asset or ecosystem type with multiple ecosystem services to manage specific ecosystems or ecosystem types (e.g., pasturelands, wetlands). (3) It may consider both multiple ecosystem types and single ecosystem services to understand the supply of a specific service across the landscape (e.g., water regulation, carbon sequestration). (4) It provides an account for the areas of the common land for better management (e.g., national parks and protected areas) (UN, 2017). Which approach to use depends on country's potential in data accessibility and quality, technical tools, and policies priorities.

In creating the pastureland SEEA-EEA for the Kyrgyz Republic it is possible to use all these four approaches by using ecosystem extent accounts, ecosystem capacity accounts, ecosystem supply and use accounts in physical and monetary units. The following accounts are relevant to estimate and develop Kyrgyz Republic's pastureland account.

### 4.4 Ecosystem extent account

One of ecosystem account units that help refine the valuation of the pastureland in the Kyrgyz Republic is the ecosystem extent account. This account focuses on an ecosystem (spatial) asset, which, in this paper, means the extent of pastureland asset within a certain area. The structure and standard of the SEEA-CF principles for asset accounts can be used.

In order to accurately find out about the pastureland extent, however, it is imperative to have accurate maps of the pastureland. In the Kyrgyz Republic, these maps are not available yet. Some available maps include rocky areas and other unproductive areas within the pastureland. Setting boundaries for pasturelands does not have clear standard and definition, causing disputes among key stakeholders, such as agricultural and forestry agencies, industries and local herders (Mestre et al., 2013).

### 4.5 Ecosystem supply and use account

This paper covers the ecosystem supply and use account by estimating benefits from pastureland ecosystem services. The disservices list will be served as opposite side of ecosystem services balance as a potential negative effect. In order to compile these accounts, the classification of pastureland services in the Kyrgyz Republic was developed. This is a specific list of services typical to the Kyrgyz pastureland.

In this classification, services are divided into two categories: provisioning and regulating/cultural services. Provisioning services produce SNA benefits. This includes food, wool, and fodder. Regulating and cultural services are regarded as non-

SNA, which implies information about extra benefits of particular services. Table 1 represents the proposed methods to estimate the ecosystem services in the Kyrgyz Republic.

For the economic evaluation, the most important ecosystem services that can be evaluated are selected (Markandya et al., 2014). These services often affect human health or livelihoods and should be taken into account when deciding. Here the economic valuation can be possible without monetary assessment.

The data sources for valuation can be found in scientific studies on ecosystems in protected areas, concentrations of plants and animals. And statistical reports of state organizations, including those of local authorities, can provide socio-economic data as well as data on existing market mechanisms (e.g., sales, services and goods, price).

The proposed classification (Table 2) mainly uses three methods of evaluation. (1) The direct method uses the market value of services, the production function of the ecosystem and market prices. (2) When there is no information on market prices and the product is only for subsistence, it is possible to calculate the value of the product as the cost value. For example, the value of irrigation water can be represented as the sum of the costs of supplying water to the field, that is, the costs of maintaining the irrigation system. (3) The method of value transfer can be used almost everywhere, where there is no possibility to conduct research. The method is also used to assess carbon sequestration and a globally important environmental service product (Markandya et al., 2014).

Table 1: Pastureland service classification and valuation methods in the Kyrgyz Republic

| **Type of services** | **Valuation and data source** | **Description** |
|---|---|---|
| *Provisioning Services* | | |
| Product: | The benefits can be measured by harvested products in physical units multiplied by market price minus production costs.<br>Data source: Statistical | The income is the gross value by sector. It is possible to analyze changes in production for 10-20 years, and estimate the loss. The main problem is to analyze changes in other production factors (e.g., fertilizers, machinery) (Markandya et al., 2014). |
| Meat | | |
| Milk | | |
| Wool or Skin | | |
| Cattle Fodder | | |
| *Regulating Services* | | |

| | | |
|---|---|---|
| Prevention of erosion | The average cost of erosion control is US$44 per hectare per year (De Groot et al., 2012).<br>Data source: agriculture and forestry department data base. | Difficult to assess without detailed information on pasture locations. Without information about water resources management services, the mean values of other countries can be used. |
| Water regulation | Water storage capacity in the ecosystem/$m^3$/per hectare; Difference between rainfall and evapotranspiration in $m^3$/ha/year (Hein, 2014).<br>Data source: Hydrometeorological data base, scientific studies. | Water regulation includes (i) flood control; (ii) maintaining dry season flows; and (iii) water quality control (e.g., trapping sediments and reducing siltation rates). Temporal, i.e. inter-annual and intra-annual, variations are important here (Hein, 2014). |
| Carbon sequestration | Ton of carbon (or carbon-dioxide) sequestered a year/hectare/$km^2$ (Hein, 2014).<br>Data source: Kyrgyz Giprozem, scientific studies. | For a preliminary assessment of carbon stocks, the average value used in other countries can be referenced (benefit transfer method); Climate Change and Terrestrial Carbon Sequestration in Central Asia (2007) provides an approximate value of carbon deposits of 0.5-4.5 tons of carbon per hectare. The estimated cost of the deposits is US$139/ton. The corresponding cost value depends on the discount rate. The rate is at 3%, to give a US$2-18.8/hectare/year (Markandya et al., 2014). |
| *Cultural Services* | | |
| Recreation and tourism | Cost of building a yurta (traditional house).<br>Data source: local district budget, land rent data | Possible costs are determined by (potential) visits by local and international visitors. |

| | | |
|---|---|---|
| Cultural and health | A net income from kumyz treatment (drink from horse milk).<br>Data source: local district budget | If there are important holidays related to agriculture (e.g., a harvest festival), then the expenses must be included. |

### 4.6 Ecosystem disservice list

Ecosystem functions also have effects that are harmful to human well-being, and these effects are called ecosystem disservices (EDS) (Döhren et al., 2015). EDS have seldom been considered in the context of broader social ecological challenges (Saunders and Luck, 2016; Shackleton et al., 2016) such as pastureland. The disservice list of the Kyrgyz pastureland was developed in this research. To have a whole picture about the ecosystem we need to include EDS.

Table 2: The disservice list of the Kyrgyz pastureland

| **Types of disservices** | **Valuation and description** |
|---|---|
| Greenhouse gas emission from livestock | A head of cow releases 70-120 kg of methane/year; The number of livestock multiplied by the emission intensities (emissions per unit of product). The emission intensity from cattle is almost 300 kg CO2-eq per kg of protein produced), meat and milk from small ruminants (165 and 112kg CO2-eq.kg respectively) and cow milk, chicken products and pork (below 100 CO2-eq/kg) (FAO, 2018). |
| Soil degradation | Prevention of degradation of natural resources as a result of soil erosion, siltation and non-agricultural wastewater is estimated at the expense of the cost of restoration activities and payment for water resources. |
| Nutrient runoff | Some nutrients run into waters (EPA, 2017). |
| Loss of wildlife habitat | Natural pasture provides important habitat to a variety of wildlife species. |

### 4.7 Ecosystem capacity account

For ecosystem capacity account in formula belowwas established by Kyrgyz scholar Isakov in 1975. The original purpose of this formula was to estimate the current feed productivity of the pastureland. Although this is not entirely relevant to the SEEA, some elements of this formula allow us to find about ecosystem conditions and services. If the pastureland deteriorates, so does the amount or quality of particular ecosystem services. For instance, feed productivity decreases. This concept is relevant to the SEEA-EEA as it also connects feed productivity with food products such as meat and wool.

The current feed productivity of the pastureland is determined by the following formula (Isakov, 1975)

$$CCcur = Y*S*0.7 / 7.5 * D \qquad (1)$$

where:
CCcur – current feed productivity of pastures
Y –edible herb yield within a pasture plot
S – pasture area
D – number of days when pasture is used
0.7 – coefficient of pasture use (based on the recommendation of "Kyrgyzgiprozem")
7.5 – the required amount of dry matter per one livestock unit per day, kg

This formula estimates potential natural forage productivity with the replacement of edible herb yield within a pastureland plot to desired yield of edible herbs within a single state in a pastureland plot (Isakov et al., 2015). The difference of the potential nature forage productivity and the current feed productivity of the pastureland inform us about degradation as an element of ecosystem capacity account. Or if we know about degradation condition, it allows us to calculate the potential nature forage productivity by adding degradation to the current feed productivity.

## 5 Conclusion

In addition to forest accounts, pastureland accounts can be part of the SEEA in the Kyrgyz Republic. This system can provide SNA and non-SNA benefits that can show the importance of natural capital accounting. In general, value may be of less significance for supporting decision-making, but changes in this value would be a relevant pointer for total changes in natural capital.

The proposed set accounts, methods and indicators within the SEEA-EEA for the pastureland of the Kyrgyz Republic show the possibility of developing the EEA even with limited available data sources. It describes pastureland conditions in accounting tables. The estimation of the pastureland value will promote the sustainable utilization of the pastureland and ultimately lead to food security of the Kyrgyz Republic. Today pastureland users pay land tax for the use of each hectare of pastureland, and the proper definition of categories can increase the budget revenue in the future.

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