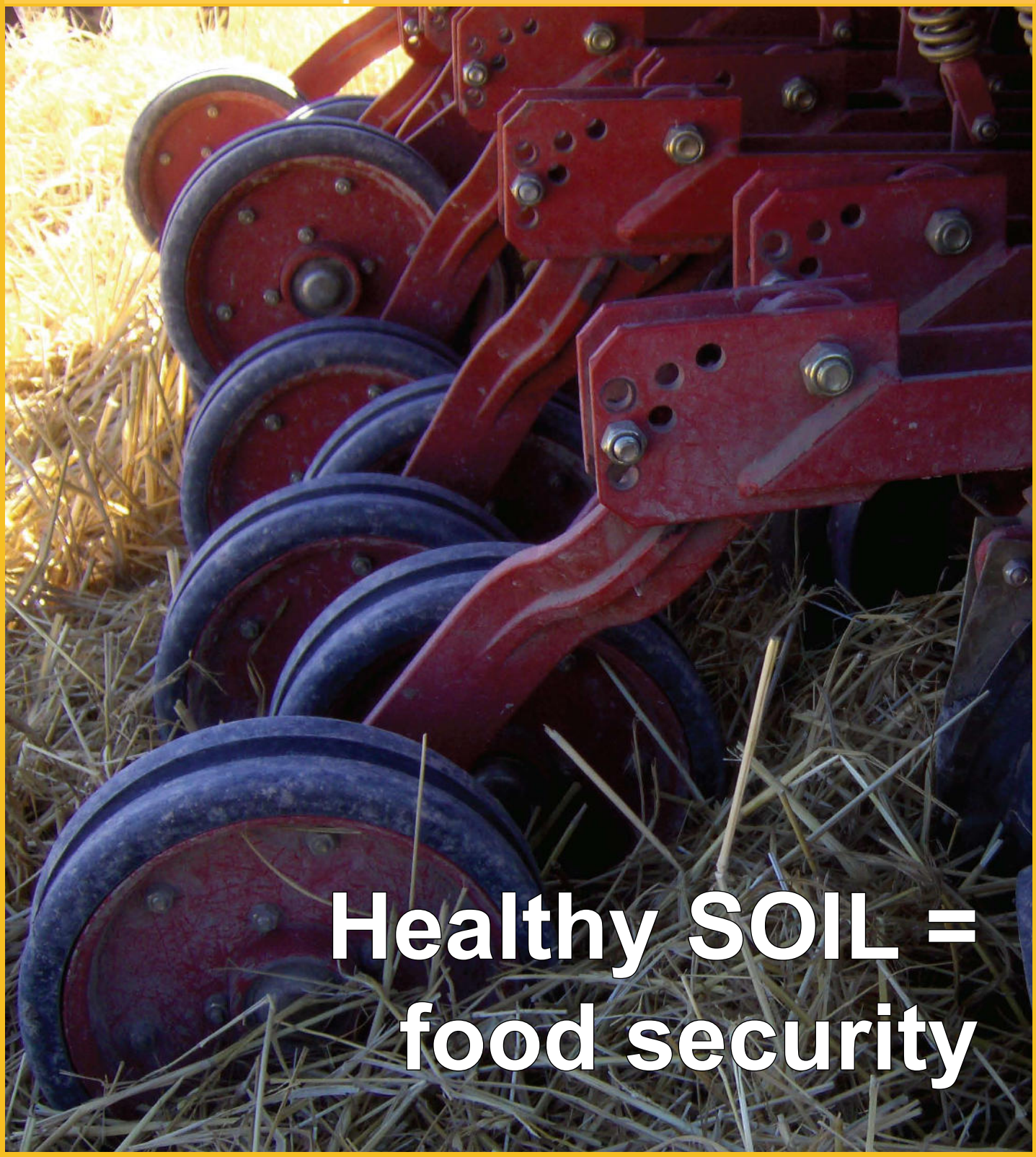
The GEF Small Grants Programme

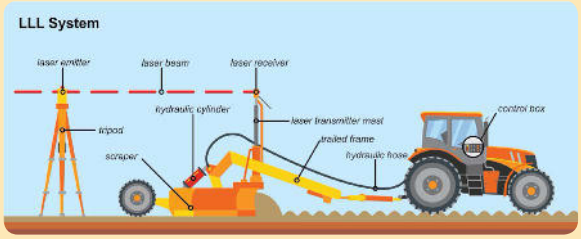
Uzbekistan

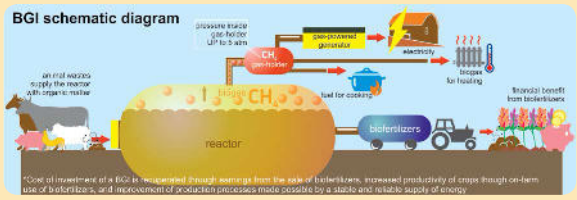
Newsletter
6
01.12.2015

LANDENERGYBIODIVERSITY



Healthy SOIL = food security





TRADITIONAL LAND USE «PEELS OFF THE SKIN» FROM THE EARTH!

Got your attention? But it is really so! The «skin» of the Earth is its soil. It is the soil that gives us an opportunity to live by allowing us to grow and harvest food. However, the continuous use of traditional farming (including intensive tillage, unsustainable grazing, deforestation for fuel and lack of reforestation, among others) destroys the soil's fertile layer and makes its less productive.

A few facts about the soil that will prepare you for further reading[1]:

– Every year, 1 mm of arable land is getting eroded.

– Currently, the global soil erosion rate exceeds the soil formation rate by **23 billion tons of soil per year.** In other words, annually, almost 1% of arable lands are lost to soil erosion.

– Arable lands erode at the same rate as the peaks of the Himalayas. In other words, we lose as much soil from the agricultural fields as from the surface of steep mountains, where the soil simply rolls and slides down the mountain hills.

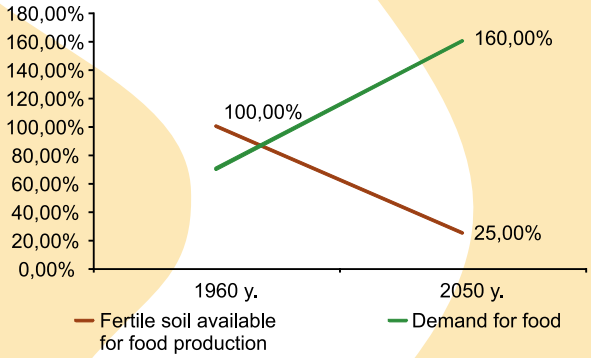
– Ploughing leaves the soil exposed to the erosion (primarily through wind and water).

– In nature, bare land can rarely be found.

– Leaving the soil without vegetation, even for a short period of time, makes it vulnerable to wind and water erosion, which increases the rate of soil loss manifold as compared to its natural rate.

Unfortunately, we still consider soil as a resource that can and should be used to obtain benefits, rather than as a capital, you would want to invest in and obtain perpetual returns. Currently, the government and land users in different countries gradually begin to think about the future of the soil. But government policies in many countries incentivize unsustainable land management practices that are detrimental to soil health, and most of land users still continue 'murderous' land-use practices.

This newsletter issue of the Global Environment Facility's Small Grants Programme (GEF SGP) in Uzbekistan, is mainly devoted to the preservation of soil fertility for ensuring long-term food security of the country. Year by year, country's population as well as global population continues to grow. In contrast, the fertility of the soil that give us food is declining.



Picture 1. Ratio of the fertile layer of soil, which is able to produce food to the demand for food

The current newsletter is an attempt to highlight the urgency in adopting land conservation practices. The sooner we will do it, the more food secure we will be in future.

In fact, the projects covered in the current newsletter underline one simple concept: as seldom as possible (and the best of all would be never) do not leave the soil uncovered. Cover the arable land with mulch of crop residues or vegetation.

Photo 1. Winter wheat under no-till with crop stubble by Aziz Nurbekov

We surely hope that this issue will trigger reflection and greater adoption of land conservation practices recommended in the newsletter. If this happens, it means that we work to a good purpose.

Enjoy the reading!

[1] Extracts and facts are borrowed from the book «Dirt: the erosion of civilisation» by D.R. Montgomery that have been kindly translated into Russian language by the United Nations Food and Agriculture Organization (FAO). We strongly recommend managers, working in the area of land use and land management in our country, to read this book. There are a lot of similar sources. However, they all emphasis one thing: soil conservation is not an environmental challenge, but a task of maintaining and enhancing human welfare.

HOW TO IMPROVE SOIL FERTILITY

Draganchuk M.

About the author:

Mikhail Ivanovich Draganchuk is the head of the peasant farm «Dragmi» (Crimea, Sakskiy region, Elizavetovo village).

The peasant farm was established in 1991 and it covered 3 ha then.

Since 2006, no-till farming was implemented on 367 ha. Currently, the farm size is 1,430 ha, and the no-till technique is used all over the farmland. The farm is situated in ***the dryland, with rainfall of 220-300 mm per year****. The following crops are grown on the farm (the average crop yield is given in parentheses): winter wheat (22 c/ha), winter barley (24 c/ha), flax (10 c/ha), chickpeas (11 c/ha), sunflower (15 c/ha).*

Year by year, soil quality is deteriorating. People are exploiting land resources to obtain necessary products. Crop problems are attempted to be solved by applying different kind of tilling methods. Unfortunately, mechanical tillage leads to the destruction of soil biota, decline in organic matter, destruction of soil structure and erosion. And as a result, the soil loses its «health» and becomes less productive.

In order to become profitable in agricultural business, the farmer has to solve a lot of problems:

– reduction of labour costs and cycle time;

– reduction of production costs;

– savings on fuel;

– increase in productivity of labour;

– reduction of deterioration of equipment;

– reduction of number of needed machinery;

– and so on and so forth.

All these components are very important for business efficiency.

However, in modern agribusiness the main challenge is the preservation of the soil, which is the main capital of this business. The fertility of the soil

Photo 1. M. Draganchuk demonstrates intercropping (double cropping) of sunflower and sainfoin on his field. Great biomass and «food» for the soil grows under sunflower plants.

will determine what we can get from our land, how much and of what quality. And it will definitely have an impact on the quality of life of farmers and of the society on the whole.

To preserve the soil it is necessary to:

– stop soil erosion (wind and water);

– reduce bulk density of soil;

– improve its structure;

– retain more soil water; and

– increase organic matter in soil.

How can it be achieved? Very easily! For this purpose farmer needs:

– to stop mechanical tillage;

– not to close up plant residues into the soil, but to mulch and leave them on its surface;

– to keep any water that falls; and

– to reduce the number of operations on the field, which will result in less soil compaction.

The table on the next page will help you to understand how each of these operations affects the solutions to the problems with soil.

By implementing zero tillage farming, all these problems can be solved.

No-till farming is the abbreviated name of the zero tillage in horticulture, and it refers to the way of sowing seeds into the soil that has not been agitated by any tillage.

When the soil remains intact and covered with plant residues, the number of all types of soil organisms (from microbes and fungi to arthropods) increases. By increasing the amount of organic matter and improving infiltration, no-till farming improves the soil.

Reduction of the number of operations on soil by applying no-till technique leads to savings in time, labour, and fuel. No-till technique allows the farmer to work less, earn more and still maintain his precious land. That is why this technique has spread throughout the world over the past 20 years. Try to find at least one more technique that would prepare the soil more carefully! So, the zero tillage is the most effective way to stop soil degradation and to restore its productivity.

Photo 2. No till drilling on soil covered with crop stubble

If in the first phase of implementation of this technique farmers face the challenge of protecting the soil from erosion and maintaining the existing level of soil fertility, then in the future the challenge of improving soil fertility becomes the new priority in their work.

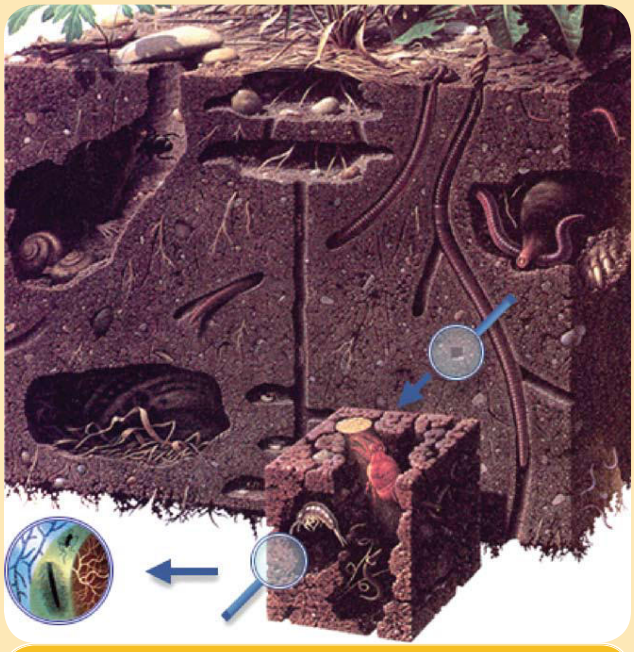
Scientists around the world are paying attention to one of the main causes of the decreased soil ferti-lity:

«Land productivity reduces dramatically because of soil erosion, salt accumulation and depletion of nutrients.

Continuous soil tillage for a long period of time kills bacteria and micro-organisms that convert organic matter into nutrients».

Professor Mary Scholes and associate professor Bob Scholes from the University of the Witwatersrand (South Africa).

Therefore, in order to effectively address the issue of soil fertility improvement, the central attention should be paid to the microorganisms living in the soil.



Picture 1. Soil microorganisms convert organic matter into nutrients

Under no-till farming, we stop agitating the soil and leave all plant residues on the surface of the soil, thus favourable conditions for the development of soil biota are created, which fa-

Table 1. The interdependence of the challenges and solutions to the problem of maintaining soil fertility

Soil conservation challenge	*Solution*	*Cause and consequences*
Control soil erosion (wind and water)	**Stop mechanical tillage**	Ploughing and other mechanical tillage contribute to disruption of the soil structure as a coherent whole, the soil becomes decomposed. This helps the wind to blow out the particles of soil and water to wash them off by watering and precipitations. Because of erosion each year about 24 billion tons of fertile soil is lost worldwide. The more we plough, the more soil is blown out and washed away.
	Do not close up crop residues in the soil, but mulch them and leave them on the soil surface	Crop residues on the soil surface prevent wind and water erosion of the fertile layer of soil.
Reduce soil compaction	**Stop mechanical tillage**	Mechanical tillage does not reduce bulk soil density, but contributes to its increase. Ploughing is like a «drug» that temporarily relieves symptoms but does not address the cause of the soil compaction, which is small amount of organic matter in the soil, the loss of soil biota and, consequently, reduction of the content of humus in the soil.
	Do not close up crop residues in the soil, but mulch them and leave them on the soil surface	Crop residues are food for the soil. The availability of the widest possible range of organic matter improves soil structure, improves its decompaction and serves as food for soil microorganisms, which "loosen" the soil.
	Reduce the number of operations on the field, that will reduce soil compaction	A greater amount of field traffic cause soil compaction. It is necessary to reduce to the field traffic to a minimum.
Improve soil structure	**Do not close up crop residues in the soil, but mulch them and leave them on the soil surface**	Crop residues are food for the soil. The availability of the widest possible range of organic matter improves soil structure and its de-compaction, and serves as food for soil microorganisms, which "loosen" the soil. It improves vertical flows of water and soil porosity.
	Stop mechanical tillage	Mechanical tillage decomposes the soil and makes it prone to erosion. It disrupts biological, chemical and physical elements of the soil. Mechanical tillage lifts the layers of the soil, increases the soil's reaction with oxygen and thereby kills anaerobic soil biota (i.e. the one that lives in the soil without oxygen). Such microorganisms are important for improving soil structure. Their loss leads to deterioration of soil structure.
	Reduce the number of operations on the field, that will reduce soil compaction	A greater level of field traffic cause soil compaction. It is necessary to reduce to the field traffic to a minimum.
	Retain rainfall water	Optimum soil moisture should be maintained in the soil. Excessive desiccation of soils and subsequent excessive watering do not contribute to the preservation of the optimal level of moisture in the soil. The more optimal the soil moisture content is, the better microorganisms function, the better the soil structure becomes.
Retain more water	**Stop mechanical tillage**	Any tillage operation opens the soil. The wind blows out the moisture from the soil faster, and the sun dries the soil up faster.
	Do not close up crop residues in the soil, but mulch them and leave them on the soil surface	Plant residues on the soil surface help to prevent moisture loss because of wind erosion and desiccation of the soil. The presence of plant residues helps to keep the moisture in the soil, reduces the amount of necessary watering on the irrigated lands and allows more crop yield due to the increased soil moisture on drylands.
Increase the amount of organic matter in the soil	**Do not close up crop residues in the soil, but mulch them and leave them on the soil surface**	At present, annually up to 1 t/ha of humus is depleted for cultivation of cotton from the arable layer of the soil. When applying 1 t of manure to the soil, only 90 kg of humus is formed. And when leaving on the field 1 t of straw, 170 kg of humus is formed. Thus, just to fill the annual losses, and to maintain the sustainable balance of humus, not less than 10 t/ha of manure should have been applied only to the arable layer of the soil, which is not the case. Crop residues are the best alternative to maintain the content of organic matter in the soil.

cilitates soil remediation. But when we harvest cultivated crop, soil bacteria lose their source of nutrition, because they eat readily available carbon, which plant roots excrete in the process of photosynthesis. And the process of development of soil microorganisms is slowed down until the next year (until the following crop growing cycle).

If we want not just to save the current soil fertility, which in itself is a challenge no. 1 for many farmers, but also to increase its level at a faster pace, then we need to feed the soil biota, when commercial crops are not planted. What is necessary to do this?

It is necessary to always **have plant roots in the soil, and permanent vegetation cover or, at least, mulch on the surface of the soil**. To this end, every year after harvesting primary culture, it is necessary to plant cover crops. In the drylands crop residues should be shredded and left as green manure on the surface of the field.

Cover crops have many important characteristics with regard to soil fertility. They are able to:

– increase the content of organic matter in the soil, which contributes to the increase organic carbon content in soil;

– increase the number and activity of beneficial soil organisms;

– accumulate plant residues on the soil surface;

– loosen and improve soil structure, improve air and water regimes;

– increase water holding capacity of the soil;

– add nitrogen by means of biological fixation (legumes);

– control the growth of weeds;

– protect the ground from soil erosion (water and wind) and overheating;

Photo 3. Cover crop residues in peasant farm «Dragmi», planted after harvesting winter barley

– contribute to the circulation of nutrients in the soil;

– retain snow and water; and

– reduce problems with pests and diseases.

They produce a large amount of green biomass and plant roots when the main commercial crop has already been harvested, which favour the increase in the number and activity of beneficial soil microorganisms. This is very important, because the growing number of bacteria in the soil leads to the improvement of soil fertility.

The surface of the soil should never be bare!

Photo 4. Cover crop residues

Although cover crops (green manure) are just one of many elements of the no-till farming, but it should be a priority when considering the improvement of soil fertility. When working on it, the fastest results can be achieved, because growing cover crops will entail changes in the whole system of no-till farming. Such elements as «crop residues», «weed control», «soil water», «nutrients», and «crop rotation» will be improved, and

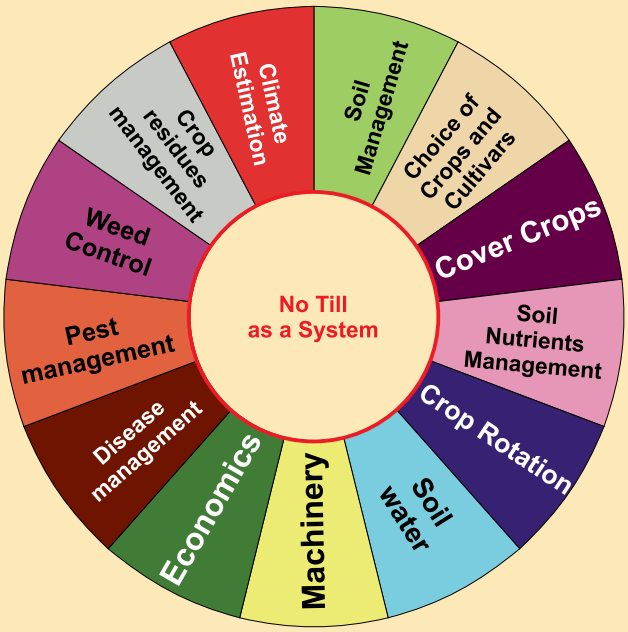


Photo 5. Cross-section of top soil with cover crops

the system itself will become more balanced and harmonious.

There are two different ways to include cover crops in crop rotation: succession cropping[1] and double cropping[2]. Cover crops can be cultivated both in monoculture and in combinations (the so-called «cocktails»), which is even better. And no matter what way of growing cover crops is chosen, the main principle should be respected: there should always be plant roots in the soil and permanent vegetation cover on the surface of the soil.

Planting cover crops between every commercial crops enables the soil to achieve the state as close to the natural as possible, and thus to dramatically accelerate the processes of soil formation, its preservation, and also to improve significantly the fertility of the soil.

Photo 6. The No-till drill in use: it cuts crop residues with disc coulter and sows seeds right after

[1] Succession cropping are crops that are sowed after harvesting annual main crops in order to get «green biomass». Crop yield is harvested in autumn. Legumes, grains and their combinations can be used as green manure.

[2] Double cropping occurs when 2 crops are grown simultaneously on one field. For example, sunflower and alfalfa can be planted on one field. Alfalfa would cover the soil between the sunflower plants and would create the green biomass, which has its advantages, such as accumulation of organics in the soil, improvement of soil structure, water retention, accumulation of nitrogen in the soil for the future harvest, etc.

HOW CAN «HEALTHY» DESERT BE PROFITABLE?

Toshpulat Radjabov

Samarkand State University

INTRODUCTION

If you look at Uzbekistan from space, you will see that most of the country's surface is occupied by deserts. About 80% of its surface can be considered arid and semi-arid lands.

Main agricultural production is being carried out in the river valleys or where irrigation infrastructure has been developed. Human settlements are concentrated in these areas. Arid lands are left for grazing and wood cutting, since these lands were once rich in timber resources. Unfortunately, people are used to associating arid lands with something bad and unproductive. But that is not accurate. Healthy arid lands can be covered with a variety of grasses, shrubs and trees. Healthy desert is a complex ecosystem with its own laws and associated biodiversity. It produces multiple products and services like any other ecosystem if people use it wisely and in a sustainable way. Here are just a few services and products of healthy arid lands that are most visible and tangible for humans:

1. Protection of infrastructure

Healthy arid land is covered with vegetation that protects habitats and infrastructure from sand accumulation. The state spends a lot of money to clean up transport infrastructure (roads and railways) from the sand, but presence of vegetation cover can significantly reduce or eliminate these costs.

2. Fodder for cattle

Arid lands are very fragile systems surviving in harsh conditions. Therefore, any injudicious intervention can seriously harm the health of drylands. This also applies to the use of the dryland for pasture. This ecosystem requires animal grazing to function properly. Desert steppes, for instance, need ungulates to help break the crust on the soil surface to stimulate the germination of dryland plants. They eat off the plant but they leave as much as is needed for further growth of the plant. Animals help spread plant seeds over vast dryland areas. Desert steppes were mostly inhabited by saiga antelope and gazelle that helped the plants spread over vast areas. But people have almost destroyed their populations, and most arid lands were left without much needed ungulates.

People have replaced ungulates with livestock. But there is a big difference between what nature does, and what a person does. Nature regulated ungulate populations in arid lands according to its carrying capacity. Animal population size formed according to the available plant food. In good years, more animals were born compared to the bad years. So desert regions have always had as many animals as they needed. Animals roamed across arid lands feeding on dryland plants and reviving them again, giving them a chance to recover. Unfortunately, people ignore these «limitations» of arid lands. People have as many animals grazing as they need and it often does not match up to the capabilities of the desert. In addition to population size, the cycle of pasture use is often not being adhered to. It makes it impossible for this land to recover.

Today, non-systematic use of pastures and overgrazing have significantly damaged the health of arid lands. Thus, arid land produces less vegetation compared to the potential productivity when it is being used in a sustainable way.

If one would try to use the resources of arid lands according to their capacity and follow the natural vegetation growth cycles as well as invest in dryland recovery, one could grow more fodder in a long term.

3. Arid resources as a source of fuel

Many elements are important for health of arid lands. One of them is dryland trees and shrubs that form the centers of plant communities. If this «center» is used wisely and in a sustainable way, it would provide firewood for local populations for a long time. If one would practice clear cutting without taking into consideration natural regrowth processes in arid lands, a bare dryland surface would thrive instead. This dryland won't produce at all. Unfortunately, this process is taking place in many areas at the moment.

It is important for the health of arid lands, as any other land, that its surface is covered with vegetation. In reality, however, vegetation cover in drylands across the country is rather uniform. Due to improper use of pastures, overgrazing, forest cutting and use of shrubs for firewood vegetation

cover is severely degraded. This kind of arid land cannot be considered healthy and it does not produce the amount of products and services that it would otherwise.

OUR APPROACH and PROJECT MODEL

We would like to convey the following with our project:

I. Arid lands should be protected as natural **capital** and as any other element of nature. To receive profit from arid land, one should invest in it. Investing in nature would enable one to receive "dividends" in the long term.

II. Cattle should be grazing in arid lands. Without livestock or wild ungulates desert will degrade. But cattle populations should be managed wisely and not exceed the carrying capacity of the system. If the carrying capacity of the land is exceeded, arid land will be degrading faster and in each subsequent year it will produce less forage.

III. One can and should collect firewood in arid lands. It should be done wisely too. Firewood can be collected from dry shrubs. But if the trees are to be cut down, no more firewood would be available.

In our project, we tried to explore what would happen if people would try to use arid lands in an unconventional way. The project was performed in Dzharkurgan district of Surkhandarya region.

This area is dominated by a sandy type of arid pasture which is mainly used for grazing. This type of pasture under overgrazing conditions is more prone to rapid change in properties of its native vegetation and soil cover compared to other types of pasture. Under non-regulated and prolonged use of sandy pasture for grazing, destruction of soil cover and then a fundamental change in natural vegetation structure can be observed. A lot of soil surface becomes broken under animal trampling and sands become mobile. They can move further to areas inhabited by humans. A significant damage to infrastructure can be caused by this process.

In addition, people living nearby cut down almost all the trees and shrubs they can find. Elders remember that when they were young, the area was covered by dry woodlands. Now one would hardly find roots of trees.

The process of sandy pasture degradation can be currently observed over large areas and is still continuing at an accelerated pace in Dzharkurgan area. Similar situations can be observed in other regions of the country.

To stop this process, a complex of phytomelioration measures (variating the types of species grown on land in order to maintain its fertility) that would restore degraded dryland is needed. It is necessary to sow and replant native species in drought-prone areas.

The main objective of the project is to create a model that will restore the health of arid land so that it could turn into a lasting source of fodder for sustainable development of dryland pasture, support livestock husbandry and serve as a stable source of firewood for local population.

The area chosen for the project is characterized by typical degraded sandy arid land. Under the influence of excessive grazing and shrub cutting, indigenous species of local flora were on the verge of extinction. Vegetation cover is represented mainly by plant species of low palatability and plants with low forage values indicating typical degradation of pasture vegetation. In terms of basic nutritional value of present plant species, this pasture was no longer able to provide fodder and was impractical for pasture use. Sands at the site were of mobile and partly mobile character (Photo 1).

During the project execution, seeding and planting of seedlings of drought-resistant forage species of local flora were performed. Field work was conducted in the winter of 2009 and 2010 in the project area of 60 hectares in total. The following plant species were used to restore and reclaim degraded pastures: Black saxaul (*Haloxylon aphyllum*), a salt-resistant shrub species *Salsola richteri*, in small quantities perennial grass species *Aristida karelinii*, and a shrub species *Calligonum microcarpum*.

The plots were observed and controlled during 5 years after planting. Animal grazing and cutting for firewood was limited. This work shows the results obtained five years after adoption of phytomelioration measures. A study was conducted to assess the results of the recovery process and the current state of the site. Field observations were carried out in the beginning of June 2015.

The results of the study showed that the recovered desert land has high fodder and wood supplies. After the successful adoption of phytomelioration measures three different types of plant communities dominated by *Calligonum microcarpum, Salsola richteri* and Black saxaul species (*Haloxylon aphyllum*) have established. The average size of the area covered by vegetation reached 37.6% which is respectively higher than in sandy pasture

Photo 1. Detail of degraded pasture land prior to the phytomelioration measures. April 2010

lands under similar conditions. A more detailed assessment of botanical and economic characteristics of each pasture type can be found in a separate article on the GEF SGP website. Here we present only several pasture types.

Currently, vegetation at the project site is showing important signs (plant species as phytoindicators) of pastures in the process of restoration. Before introduction of the measures, the project area was represented by two main plant communities which had very low forage values. After the adoption of phytomelioration measures, which were running for five years, these plant associations naturally gave way to other characteristic plant species. They formed a healthy pasture with more characteristic sandy dryland vegetation communities with high economic value. Restoration and development of different plant communities (Astragalus, Aristida species, etc.) contributed to consolidation of sand and thus formed the necessary conditions for development of other annual and perennial plant species (Photo 3).

POTENTIAL FOR FORAGE PRODUCTION

Forage potential was evaluated for the plant species in the project area. Sections with different

Photo 2. Self-regeneration of Bindweed species (*Convolvulus divaricatus*)

Photo 3. Stabilizing the sands by *Aristida karelinii* species

dominant species can vary in their fodder values. *Calligonum*-dominated plant community type had a total of 18.0 centner/ha productivity of perennial and annual plants. Total productivity of *Salsola richteri* is 25.3 centner/ha. The highest increase in productivity was found in Black saxaul dominated plant community where the annual growth of vegetation was 57.5 centner/ha.

The project area was grazed by cattle owned by one family throughout the study period. Accurate livestock population data could not be obtained. Field observations showed that lack of grazing on pastures of the project area during five years started to affect the occurrence of some important plant species. It is another piece of evidence for the important presence of grazing animals. Lack of grazing in rangeland areas contributes to accumulation of dead plant matter. In the long term it worsens the condition of vegetation that eventually leads to pasture degradation. Balanced pasture use is essential for keeping the desert in its healthiest state.

Photo 4. General view of *Callygonum microcarpum* dominated vegetation type

Photo 5. General view of *Salsola richteri* dominated vegetation type

The rate of grazing in arid areas is 0,2-0,3 small cattle heads per 1 hectare.

According to obtained results, we can say that **following the reclamation**, this area can produce 33 kg/ha of fodder per year on average. At a daily rate of fodder needed for one sheep being 2.5 kg dry matter the land can produce enough feed for 2 small cattle heads per hectare without compromising the long-term condition of dryland vegetation.

Thus, forage from three different types of pasture in the project area has high fodder quality values. Under natural conditions, plant species that are typical for sandy pasture, would not have such a high productivity. Once sown in the project area, however, their productivity increased compared to performance in other conditions.

It should be noted that most of the forage consisted of a single plant species. Thus, in the Saxaul and *Salsola* dominated plant communities main fodder component (90%) accounted for such species as Black saxaul and *Salsola* species. Extremely high accumulation of annual growth in the project area was primarily associated with high plant density, which does not always have positive consequences. The number of Black saxaul plant individuals in Saxaul dominated plant communities was characterized by high numbers of dominant species occurrence which reached up to 2,235 individu-

Photo 6. General view of Black saxaul dominated vegetation type

Photo 7. Successful development of *Salsola richteri* plant on previously degraded pastures. Plant height is about 3.5 meters

als per hectare. However, the optimal plant density of Black saxaul should be within the range of 800-1,000 individuals per hectare (Shamsutdinov, 1975). In fact, the natural rate was doubled in this case. It shows that black Saxaul can also be used sustainably for firewood (see below). This indicator in the project area is much higher than the recommended standard rate.

An identical situation with high feed stocks was observed in *Salsola richteri* vegetation community where 94% of the annual increase was accounted for by *Salsola richteri* species. Dominance of one plant species in this case (despite success in species productivity) does not provide enough diversity in animal forage. From this perspective, emergence and spread of other shrub and semi-shrub plant species in vegetation composition can be a criteria for increasing the economic value of arid land in the project area.

FIREWOOD SUPPLY

Study findings have shown that restored areas have high volume of timber stock. The main species in each grazing area are represented by dominant species*: Salsola richteri*, Saxaul and *Calligonum microcarpum*. *Calligonum microcarpum* dominated plant communities have relatively low contribution to the overall timber stock. Below we present the timber supply for each species.

Photo 8. The diameter of Salsola richteri trunk can reach up to 13.4 cm

***Salsola richteri* dominated communities.** Studies have shown that *Salsola richteri* dominated vegetation types performed best on sandy soils after five vegetation seasons following the phytomelioration measures. In addition to accumulation of large fodder supplies, this species also had a high stock of timber. Average number of *Salsola richteri* individuals per hectare was 502 plants. Due to favorable soil conditions average *Salsola richteri* species height was 3.6-3.8 m, and the diameter of its crown ranged from 4.0-4.5 m (Photo 7).

According to our calculations, *Salsola richteri* species formed 14.6 tons of dry wood mass per hectare in sandy pasture of the project area.

***Haloxylon aphyllum* (Black saxaul) dominated communities.** A peculiar feature of Black saxaul grove is a high rate of the plant density per unit area. The average height of the plant varies between 2.5-3.0 m and 2.0-2.5 m in crown diameter. Black saxaul vegetation communities formed a dense thicket during the five years after the phytomelioration measures, which led to a significant accumulation of wood stock. According to our estimates, the average number of Black saxaul individuals is 2235 plants per hectare. It generated 14.1 tons of Black saxaul dry wood mass. 82% wood stock of *Haloxylon aphyllum* had on average a stem diameter of 3 to 8 cm. The remainder of the timber stock consists of secondary shoots. Their thickness is less than 3 cm.

Photo 9. Height of a large *Calligolum microcarpum* individual reaches 3 m on fixed sands

***Calligolum microcarpum* dominated communities.** *Calligonum microcarpum* dominated communities have a relatively low potential in forming the wood stock compared to *Salsola richteri* and Saxaul species. This is due to the smaller size of the crown of the plant and particularly intense branching of secondary shoots. Average height of the crown is about 1.3-1.5 m with an average diameter of the crown 1.7-1.9 m. The exception were the bushes. Their height exceeded 3.0 m (Photo 9).

Average number of *Calligonum microcarpum* species per hectare was about 1,400 plant individuals. Despite the high number of *Calligonum microcarpum* individuals, it formed about 1.5 tons of air-dry timber per hectare.

Thus, remedial measures in degraded areas contributed to a significant accumulation of timber stock in the pasture area. On average, three pasture areas produced 10.1 tons of dry mass wood stock per hectare. As previously indicated, Black saxaul and *Salsola richteri* species were characterized by high rates of wood stock produced. It is therefore necessary to reduce the numbers of *Calligonum microcarpum* plant species to improve sustainability of pasture ecosystems. That is why planned phytosanitary logging in these areas is a necessary control measure.

Average volume of wood cutting can reach up to 1-3 tons/hectare per year on average after phytomelioration measures to manage the desert in a sustainable way without adverse effects on human health or health of the ecosystem.

SIMPLE CALCULATIONS

Unfortunately, to date, we were unable to conduct a full economic analysis for calculating the effects of drylands recovery. But simple calculations can be done for each farmer or residents of desert lands who own degraded areas.

The cost of dryland restoration can be reduced to several components:

1. Work and time necessary to collect seeds. All seeds of the plants to be seeded in the area to be recovered area can be collected manually. For optimal plant mixture to be used for dryland restoration 3 to 5 kg of seeds are sufficient. One person can collect this amount of seeds in few hours.

2. Sowing seeds. Sowing seeds can be performed in several ways. a) Manual sowing is the cheapest but most time-consuming method. One hectare of the area can be planted by one person in 2 to 3 hours. b) Sowing using machinery

Photo 10. Seeding of Black saxaul plant seeds using a mini tractor at Djeiran Ecocenter.
After the tractor prepared the land, the seeds of Saxaul are planted, which are afterwards covered with soil by using the harrow

such as simple tractor with harrow. Costs of this method depend on the type of machinery used, its rental value and the cost of fuel used in the process of seeding. c) Using cattle in the process of sowing is the most effective method. The area of planned reclamation is to be walked over by a flock of sheep, then manually sowed with seeds, after which the sheep flock is to be walked over the area again. Thus, the hooves of sheep will contribute to establishing of seeds in the soil.

3. The costs of protection of the land from the potential damage. It is probably the most important task to prevent the restored area from premature and excessive use. It is necessary to «give rest» to the recovered area for 2 to 3 years and prevent grazing and cutting of vegetation in these areas. In

Photo 11. The project owns its success to the dedication of Dzhumaev family

Photo 12. A panoramic view of the degraded desert area (on the left of the road) and of the restored one (on the right)

our project, protection of restored area was made possible by the family of Namoz Dzhumaev.

As a reward for restoration of the dryland area the owner receives up to 2-3 tons/hectare of firewood per year and the possibility of using the area for pasture with 2-3 heads of small ruminant cattle. Taking into account the average cost of Black saxaul and *Salsola richteri* wood of 0.2-0.3 USD per 1 kg[1] and the average cost of small ruminant cattle heads of 150 USD, 1 ha of dryland can bring the owner on average annual income of 300-500 USD. Based on this estimated value recovered arid area of 60 hectares generates 18,000-30,000 USD income in a year. At the same time, direct investment costs can be difficult to calculate. But according to rough estimates, primary reclamation costs account for about 3,000-4,000 USD. Subsequent costs are equal to the costs of protecting the area and sustainable management of arid land (costs of grazing and sanitary cutting).

The wholesale price of Black saxaul wood in Kazakhstan and Russia is 160-180 USD per ton. In fact, establishment of commercial Saxaul plantations with a sustainable method of dead wood collection and sanitary wood trimming can also serve as a good example of a business model. It can at the same time become a solution for a global problem of restoration of desert lands in Uzbekistan.

PRACTICAL RECOMMENDATIONS

The obtained results and their analysis are the basis for our conclusion that this model of degraded sandy drylands, as in the Dzharkurgan area, has a high potential for widespread use in other degraded deserts in Uzbekistan. We have a lot of desert lands, particularly degraded dry pastures, which can and should be restored. People living in these areas could then receive a stable income. Several simple things have to be done to achieve this:

– take the above steps to restore the desert land;

– manage arid ecosystems wisely through limiting current resource use so that in the future desert could recover on its own;

– observe nature and try to «copy» the natural processes.

Based on the experience gained in Surkhandarya region we can give some practical recommendations for the continuation of this experience:

– Those who want to restore the desert to generate income, need to sow a mixture of dryland plant species, diversify fodder plant species and various semi-shrub species, especially Black saxaul and *Salsola richteri*. This will help create a multi-season pasture.

– Grazing in arid lands is recommended in early spring and late autumn and winter. Animals would feed on perennial semi-shrub and shrub species. In summer grazing is not recommended, as sandy rangelands are prone to rapid destruction of the structure of sands under animal hooves. It is important to adhere to the recommended rates of grazing.

– It is necessary to carry out a systematic and rational phytosanitary trimming of Black saxaul and *Salsola richteri* plant species.

GEF SGP is ready to continue work on restoration of desert land and is waiting for proposals from interested parties.

REFERENCES

Guidelines for geobotanical survey of natural grasslands of Uzbekistan. – Tashkent: Fan, 1980. – 170 pp.

Shamsutdinov Z.Sh. Creating long-term pastures in the arid zone of Central Asia. – Tashkent: Fan, 1975. – 175 pp.

[1] Wholesale price on the markets of Kazakhstan and Russia.

THE MOST VALUABLE INVESTMENT IN AGRICULTURE GIVES THE GREATEST DIVIDENDS[1]

Alexey Volkov

Farming, even when it is facing challenges, is only being handled as a business activity aimed at bringing profit. The effectiveness of agribusiness depends, however, on how well a business owner or owners (in this business farmers) manage this kind of business and all associated processes, particularly in the long term.

It is well known that the main factors of agricultural production are labor, land (resources) and capital. And therein lies the main problem that agriculture is currently facing in our country. **Nature is commonly viewed as a resource that has to be utilized but not as a capital worth investing in to receive additional products in the future. This perspective has to be changed for agriculture to thrive and develop in a sustainable way.**

Soil, water, and biodiversity are at the core of the main agricultural assets. One does not receive natural capital for free. One should constantly invest in it and always maintain its optimal working condition. Only in this way can natural capital work efficiently in order to create additional products. In other words, the farmer has to invest in his own resources to get profit (dividends) from them. But the problem persists in the fact that farmers do not view nature (soil, water and biodiversity) as capital. They see nature as a resource that is mostly free to use. However, one must invest in order to receive.

This concept defines many known problems in using natural resources in agribusiness. As mentioned above, natural resources, including soil, water, and biodiversity, represent capital resources in agribusiness. But they can undergo "depreciation" on the long-term without investing in their maintenance.

SOIL RESOURCES

Let's start with soils. Agricultural activity should be as productive as possible to be considered a lucrative business. Since agriculture is dependent on soil resources, soils should be kept fertile and healthy in a long-term perspective. To harvest sufficient amounts of various crops, soils should have a certain level of fertility without drastic fluctuations in it. In a way, this approach resembles the way of maintaining vehicles and machinery: **one should invest in soils so that they stay fertile for generations to come**.

Photo 1. Traditional soil processing method of plowing is destroying the fertile layer and microorganisms in the soil

Soil fertility and health also depend on many biological processes. Microorganisms that work and live in the soil are needed for these processes. They, in turn, need food. Food for the microorganisms is an organic component in these processes. Without this component, no humus will be formed and soils will lose fertility. It is common knowledge among the farmers but only a few take action to support organic matter content accumulation in the soil. After just one harvest of wheat or cotton from a hectare-sized field, about one ton of humus can be withdrawn. Organic matter is also lost in the form of the harvest itself and plant stems and leaves. One hectare of only crop stalks and leaves can lose up to 22 tons of organic matter within 17-18 months. For soils to remain fertile, it is necessary to replenish the withdrawn organic matter so that it is transformed into humus.

Now let us discuss **how to enrich the soils with organic matter.** Organic matter content needs to be constantly replenished. Adding one ton of manure produces only 90 kg of humus. In order to make up for one ton lost from soil as a capital resource, the farmer must contribute back into the soil not less than 10 tons of manure per 1 ha. But this is not always happening. Farmers do not consider proper fertilizing necessary, as the soil is being viewed as a resource that must be used, not as a capital that has to be protected and replenished.

But the farmer should take care of the soil. And we will discuss here other, more useful alternatives for

[1] The article has been prepared to support the conference on Priority directions of stable agribusiness development under modernization in agriculture, Tashkent, 2015.

[2] There are other abiotic processes besides the ones in the soil. Soil fertility is also dependent on optimal climatic conditions.

Photo 2. Mulching is a way of protecting soil and an important method stimulating humus production by soil microorganisms

soil conservation and increasing organic matter content for its transformation into humus.

NO TILL FARMING TECHNOLOGY

It is necessary to consider and stop plowing the soil although it might sound illogical at first. No till technology has existed for a long time and it is actively being developed around the world. In Uzbekistan, this technology is developing and spreading very slowly with only the first tentative steps being taken.

To start with, we will discuss why one should restrain from plowing the soil. During the plowing process, the upper fertile layer of the soil becomes exposed to wind and water erosion. The magnitude of these processes is higher under plowing compared to the rates of erosion under natural conditions in each given area. Furthermore, traditional plowing practices cause the loss of soil microorganisms. Soil microorganisms are then literally washed out of the soil and cause further soil microbial diversity depletion. The presence of these microorganisms, however, is essential for soil health since they work on «repairing» it.

Now we will explain why we should use no till technology. Basically, these are the same reasons as incentives for soil conservation mentioned above. No till technology does not destroy soil and preserves all the different microorganisms in it. An integral part of this technology is mulching plant residues and leaving them on the soil surface. Mulch is the organic matter that is needed as a source of «food» for soil microorganisms that convert it into humus. In addition, soils being managed through no till technology and mulching remain protected from wind and water erosion, maintaining the important fertile layer. Mulching also keeps moisture in the soil, saving large amounts of water for irrigation and creating more favorable conditions for the life of soil microorganisms. Traditional plowing technology leaves the soil bare and exposed to the solar radiation.

We should also note that using no till technology, the farmer spends much less financial and material resources for manufacturing operations.

PHYTOMELIORATION AND GREEN MANURING

Both of these technologies are intended to serve the same purpose: to enrich the levels of soil organic matter. Green manuring denotes sowing crops with a purpose of leaving them on the ground as fertilizer for the production of organic matter. The farmer does not harvest or sell these crops. Phytomelioration is a broader concept of improving the land by means of plant propagation. We will devote more attention to phytomelioration in the next newsletter.

Table 1. A comparison of benefits for growing wheat on traditional technology and No tillage

Indicators	Plowing as usual	No till technology
Productivity, centner (100kg) /ha	23.3	18.9*
Gross income, sum	2,330 x 292=680,360	1,890 x 292=551,880
Expenses, sum	564,600	385600
Cost price per 1 kg grain	242.3	204.0
Net income, sum	680,360 - 564,600=115,760	551,880 - 385,600=166,280
Profitability,%	20.5%	43.1%

**The low yield under no-tillage was determined by the fact that the field under no-tillage was watered only twice per agricultural cycle, whereas the field with traditional tillage was watered six times. If the field was watered under no-tillage as many times as under traditional tillage, the yield would be the same (or even more)*

Green manuring is one of those tools of enriching soil organic matter and improving soil as a natural capital that we have mentioned above. The farmer can invest in soil capital by applying the green manuring technique on his land. Since crops used in the process of green manuring stay on the ground, soil organic matter is returned to the soil. Thus the farmer can invest in soil fertility for the future productive use of his land.

However, investing in the future of this natural capital component is viewed negatively by many farmers. It can be even described as a phantom perspective from the viewpoint of a farmer caring about productivity of his crops at present. It's hard to translate management for sustainable soil fertility in the specific figure of the income for «tomorrow's» needs in agribusiness. In addition, to invest in fertility, the farmer has to spend money «today» while the income will only be generated in the future. It is very difficult to calculate how much additional yield would be generated from additional content of organic matter in the soil and how much an increase of the humus content, for example, from 0.5% to 0.7%, would bring to the farmer. But it should and it can be evaluated in monetary terms for each farmer.

As in any other business, one needs to figure out which investments will bring the highest benefit. Therefore, affordable ways to return the soil organic matter should be calculated for each individual farmer. Since all farmers have different resources available, figuring out the best option requires taking into account this and other factors. One farmer can have a lot of available manure for soil fertilization while another one might not have access to sufficient water resources and cannot afford to sow the crops purely for the purpose of green manuring. The farmer still has an option of using mulch and winter crops for enriching soil humus content in this case.

WATER RESOURCES

The situation with the availability and use of water resources in agriculture is much more complicated. If a farmer receives the land for a long period (49 years for example) he will actively consider it important to maintain fertile soil for his future crops. But generally water resource use can be described as extremely wasteful. Since the natural precipitation amount varies annually, sustainable use of irrigation water tends to be a novelty among farmers.

A possible approach to treating water resources as natural capital through investing in them is preserving the soil moisture. You can see how the moisture retention process occurs in natural conditions: there is no excessive watering. This can only be found for floodplain ecosystems, such as **riparian** forests. In other cases the soil primarily receives the moisture from precipitation events. Soil moisture can be kept more stable by having a vegetation cover rather than leaving arable land bare. These same methods can and should be borrowed from nature and applied in agriculture. By and large, this has been done in other countries, and continues to be widely implemented. The same should be done in our country.

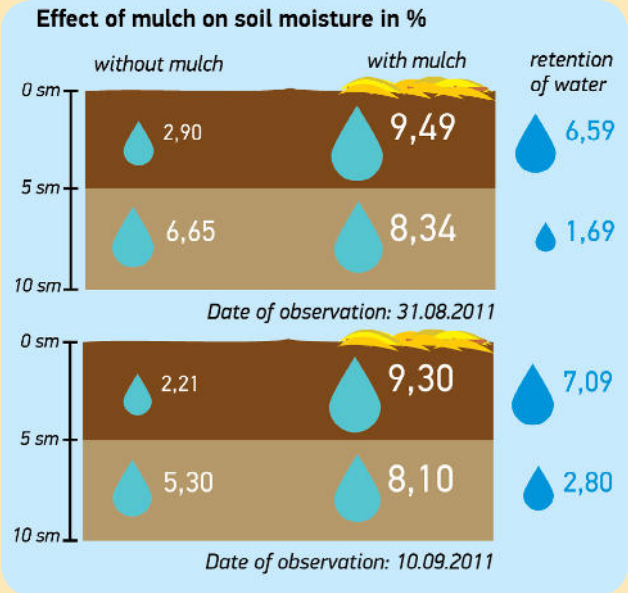
Drip irrigation

The government has committed itself to the development of this technology. Unfortunately, we are moving in this direction only by farmers who are open for advanced technology or farmers whose lands experience water shortages. Analysis conducted by an NGO «KRASS»[3], within our project on drip irrigation in Namangan region, showed that this technology could lead to significant improvement in many performance indicators. But farmers face difficulties in order to obtain promised loans for purchasing drip irrigation systems due to a large number of administrative barriers. For this reason, adoption of drip irrigation technology is moving forward very slowly.

No till technology

Using no till technology and mulching does not only protect soils and retain water. Advantages from practicing this management technology go beyond that. Total savings of water/keeping higher moisture levels can reach up to 2,000 m^3/ha.

There are a number of other technologies for water conservation, including the laser leveling of fields with



For more details please visit:
http://sgp.uz/ru/publications/publications/787

[3] See the article on the economic analysis of the use of drip irrigation systems on our website: http://sgp.uz/en/projects/climate_change/942

Cost-benefit analysis of drip irrigation system introduction compared to the traditional irrigation method. All calculations are presented per 10 hectare-sized area					
Indicators	Unit	Cotton, 10 ha	Wheat, 10 ha	Orchard (apple), 10 ha	Remarks
Investments	**Soum**	**88,360,000**	**91,560,000**	**50,360,000**	The cost of a drip irrigation system included the cost of purchasing the film to cover the reservoir for supplying water to the drip irrigation system
Total benefits	**Soum/ year**	**26,890,709**	**21,450,729**	**30,104,813**	Compared to traditional irrigation
Reducing water resources usage	m^3/year	117,600	66,000	114,550	Saving water was calculated on basis of differences in irrigation technologies (watering frequency)
Energy usage savings	Soum/ year	4,999,680	3,175,200	3,206,784	Due to a significant reduction in run time of the pumps power consumption was significantly reduced for the season
Saving diesel fuel	Soum/ year	1,087,500	37,500	37,500	Diesel fuel was saved by reducing the number of agro-technical measures. Price is 2,500 sum per liter on average*
Saving on agro-technical measures (cultivation, fertilization, etc.)	Soum/ year	850,000	50,000	50,000	
Saving on mineral fertilizer	Soum/ year	1,143,000	377,500	0	Assimilation rate of mineral fertilizers is 90-95%, whereas under traditional irrigation it is 30-35%
Savings on manpower	Soum/ year	2,000,000	2,000,000	2,000,000	
Benefit from productivity increase	Soum/ year	16,000,000	15,000,000	24,000,000	Productivity is increased by about 40%, but depends on the quality rating of the soil in each case
Exemption from land tax	Soum/ year	810,529	810,529	810,529	Soil-score of the land taken as 60 on average (6th grade of the soil, correction factor is 6.78). Land tax is taken as for base grade 1 land (11,954.7 sum) in Uychi district of Namangan region.
Payback period	***years***	***3.3***	***4.3***	***1.7***	
** Prices are given at the time of preparing of the economic analysis in 2013*					

Retention of soil moisture due to mulch:

233,4–276,9 m³ per hectare

Water saved by mulching during the annual flushing of salt from the soil:

1000 m³ per hectare

Total water saved by preserving soil moisture during the growing season and due to a reduction in saline accumulation thanks to mulch:

2000 m³ per hectare

For more details please visit:
http://sgp.uz/ru/publications/publications/787

savings up to 25% of irrigation water, and the separation of irrigation channels in the network from water users associations, with potential savings of up to 50% water used for irrigation, which we described earlier.[4]

BIODIVERSITY

Farmers usually don't consider biodiversity as an important element of natural capital in their agricultural activity. However, pollinators, for example, constitute one of the main biodiversity elements important for increased productivity and plant development processes. If there are no pollinators, productivity will fall steadily. Nature did not create in vain a similar mechanism of plant propagation. It needs the help of insects that carry pollen. A number of studies have assessed the value of pollination services for agriculture. Global yields without pollinators would have decreased in the amount of 190-300 billion euros per year. Farmers in many countries pay beekeepers to have beehives close to the fields during flowering season. We have, unfortunately, only few measures for using pollinators, both wild and domesticated (honeybees).

What should be done to support pollinators? First, there is a need to create islands of habitats for wild

Increase in yield in presence of pollinating bees*
In horticulture:
1.19 times – from peach trees to 26.4 times from cherry trees
Cotton yield:
Number of boxes +43.6%
Cotton weight +12.8%

**Data provided by Sherali Suyarkulov, Fergana Union of Beekeepers, fspbee@gmail.com*

pollinators and birds. These specially designated areas should not have human interference to limit the growth of wild vegetation. In many western countries, farmers use the following algorithm. For every 100 hectares of arable land they set aside 0.1 to 1 hectare of wilderness, dominated by shrubs and trees. Insects and birds feeding on pests should have a habitat in close proximity to farmers' fields that should be pollinated. One study showed that coffee yields, for example, fall up to 20% if the habitat of pollinators is at a distance greater than 1 km from coffee plantations. For many farmers in our country, it may seem strange and unnecessary. And this lack of understanding again comes from ignoring the need to recognize the importance of natural capital for agribusiness.

Islets of wildlife can be replaced with other habitats, but they should rather be complemented with hedgerows (or shelter belts) that in themselves carry a lot of other useful features, such as prevention of topsoil loss through reducing wind speeds and wind erosion. It would in turn mean increase in soil moisture and better water conservation. Hedgerow vegetation could also be a source of firewood and could be used for other purposes.

Another way to increase natural pollination services is to promote beekeeping and avoiding the use of chemicals that kills insects. We need to move from artificial plant protection methods to more natural, biological ones.

In conclusion, we would like to note that often, despite the efforts that a man can make in a way he manages the land, nature does a better job. That is why it is necessary to observe the processes in nature, carefully study them and try to repeat them. A change of thinking and viewing nature as capital will bring dividends. These dividends will be higher than those that farmers are currently getting. It is necessary to understand that soil, water, and biodiversity are irreplaceable elements of natural capital in agriculture and, as any capital investment, require preservation and sustainable improvement so that they can add value to agricultural products in the long term.

[4] Issue number 4 newsletter GEF SGP, which can be found on our website: http://sgp.uz/en/thematic-gef/publications/782

LASER LAND LEVELING: FROM INTRODUCTION TO THE DOMESTIC EQUIPMENT PRODUCTION

Promotion of laser land levelling (LLL) technology in agriculture is one of the achievements that were implemented successfully in Uzbekistan over the past few years.

Land laser leveling refers to the technology of mechanized land leveling with laser emitter and special trailed equipment that is installed on tractor and scraper. LLL helps to achieve leveling of the land within ± 3 cm range and less along the axis. When field surface is perfectly leveled – there are no indentations and elevations – the farmer achieves uniform water distribution, and reduces water consumption by 20-25%, which is especially important for our country. Uniform irrigation also leads to even crop growth that increases the yield by 5-10%.

Currently, laser leveling of agricultural fields was successfully introduced and implemented in five regions of Uzbekistan: Khorezm, Karakalpakstan, Kashkadarya, Samarkand and Namangan regions. As a result, by having leveled more than 2,000 hectares of land, farmers managed to improve land quality. At present, a project on LLL implementation is launched in Surkhandarya region.

Implementation of LLL addresses two major irrigated agriculture problems which our country currently faces:

– decrease of soil fertility and, as a consequence, reduction of agricultural productivity;

– reduction of the amount of water suitable for agricultural purposes.

Our partners' projects on implementation of LLL with the support of GEF SGP has demonstrated the benefits and advantages of the technology:

1. Rational use of water resources: savings on watering up to 20-25%.

2. Reduction of the amount of water needed for the field surface preparation (washing out of salt and provisional soil watering).

3. Dense and even crop growth.

4. Uniform soil watering.

5. Better product quality and higher yield (up to 5-10%).

6. Return on investment period: 1-2 years.

This approach also influences soil conservation and other indicators such as:

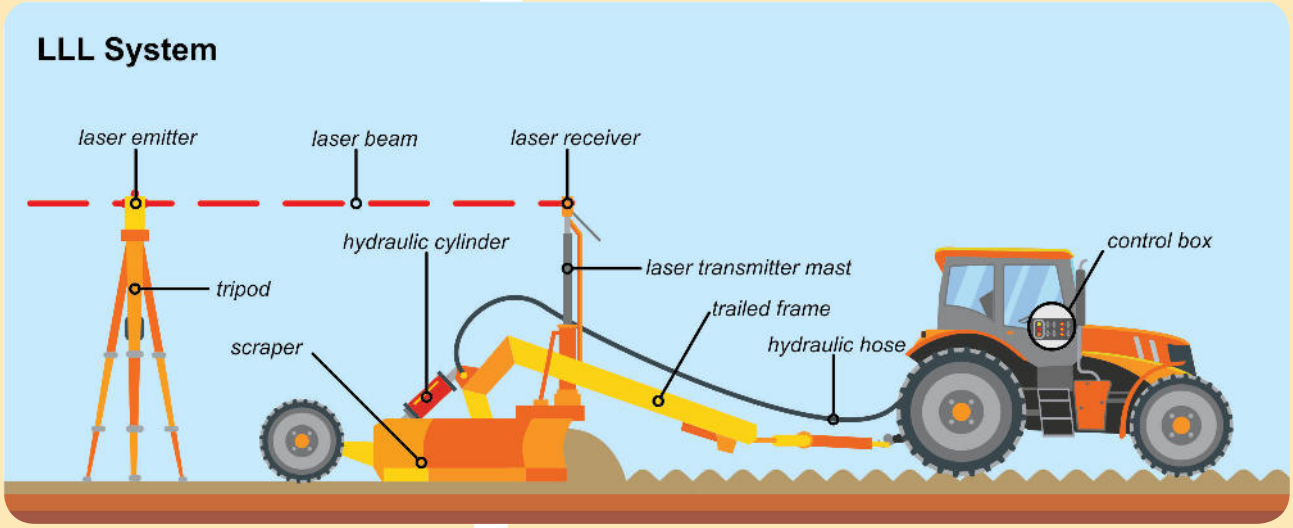
1. Reduction of soil salinization (desalination).

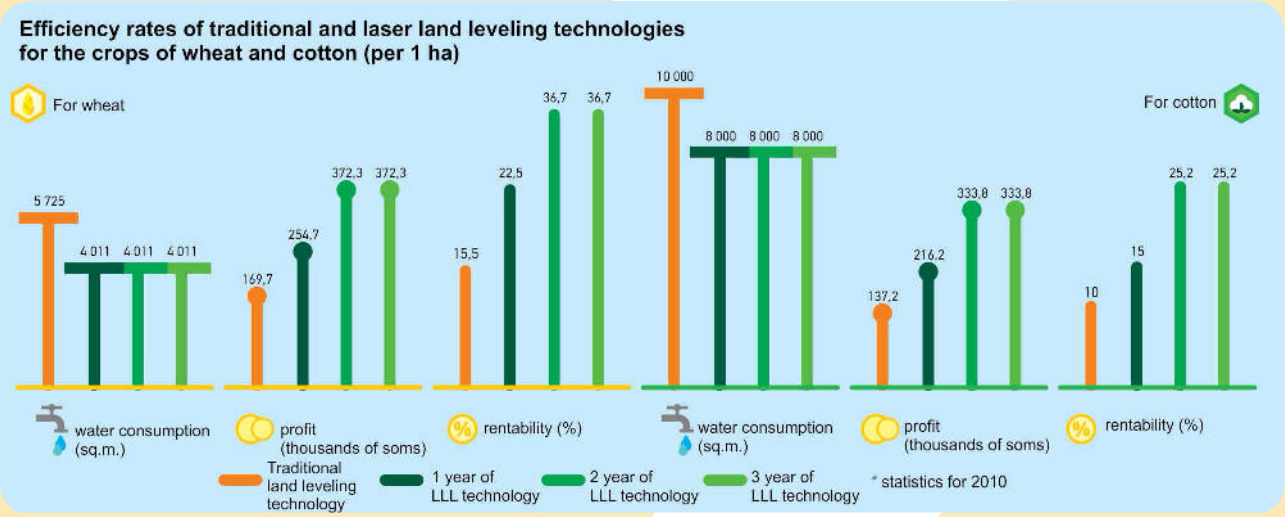
2. Conservation of soil fertility.

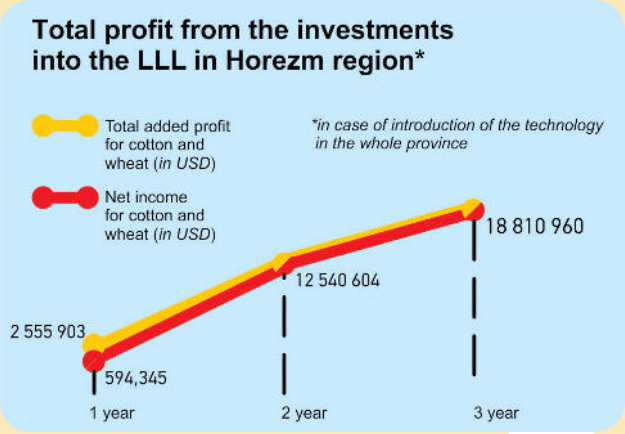
3. More effective weed management.

Positive results of the technology's implementation has attracted attention of the governmental structures. Currently, Uzbekistan adopted the State programme for the implementation and distribution of high-performance agricultural machinery in the country's regions, which deservedly include LLL equipment. It is worth noting that the production of LLL equipment is also included in the State investment programme within the framework of the Decree of the President № 1758 of May 21, 2012 and № 2069 of November 18, 2013. The government aims to start domestic production of the LLL equipment in the country.

The representative of agricultural machinery manufacturers turned to the GEF SGP in order to assist in developing modern production of the LLL equipment, and to help to increase localization of the domestic production. The first strategic project – «As-







sistance in localization of agricultural equipment production to implement conservation agriculture (lasers, laser levels and no-till pneumatic/mechanical drills)» was approved by the GEF SGP and had already been launched. The initiator of the project is the association of joint-stock companies «AGROTEXT'AMIR».

In the context of the project, modernization of production capacity of the «CHIRCHIQMASHAGRO» company was carried out; the company already produces laser levels and other agricultural equipment. Laser levels and scraper' production lines have already been modernized. In addition, the purchased equipment will also enable production of no-tillage drills which the company is considering launching in the near future.

Domestic LLL production will make the equipment affordable for the farmers of Uzbekistan and will facilitate introduction of the technology across the country.

The widespread implementation of laser land levelling will allow Uzbekistan to increase its agricultural productivity and to reduce the cost of water for agricultural production.

SPECIAL OFFER

Within the framework of the newly launched project on localisation of the LLL equipment production, the GEF SGP will offer a reduced price on purchase of laser equipment for the country's farmers.
The calculations should be made in the national currency of Uzbekistan (Uzbekistan soum) at the exchange rate actual on the date of the payment. You may lease additional equipment from the existing leasing companies, already working with the manufacturer. In order to buy the equipment at a discount price, farmer must contact the GEF SGP as follows:

The Global Environmental Facility's Small Grants Programme in Uzbekistan
Tashkent, 100015, Mirabadskaya st., 41/3
Tel: + 998 71 120 34 50
Fax: + 998 71 120 34 85
E-mail: alexey.volkov@undp.org

The GEF SGP will provide you with all information needed to buy the equipment.

In total, 71 laser levels of various productivity will be offered at a discount price. The discount rates and prices are provided in the table below:

Equipment	Factory price	Price reduction in %	Price for 1 kit with the reduction from GEF SGP	Quantity of the available equipment for the reduced price
Laser land level: Width of scraper bowl's cut – 5 m Components: – Front frame; – Rear frame; – Scraper; – 4 wheels; – Laser equipment (laser level head/transmitter, receiver, control panel, cables); – Hydraulic system (hydraulic valve, hydraulic cylinder to lift the bowl/to open left and right side bars of the bowl, reduction device with hydraulic pump, oil filter); – User manual.	$17,350	15%	$14,726	21
Laser land level: Width of scraper bowl's cut – from 3,5 m Components: – Front frame; – Rear frame; – Scraper; – 2 wheels; – Laser equipment (laser level head/transmitter, receiver, control panel, cables); – Hydraulic system (hydraulic valve, hydraulic cylinder to lift the bowl/to open left and right side bars of the bowl, reduction device with hydraulic pump, oil filter); – User manual.	$16,725	15%	$14,216.25	20
Laser land level: Width of scraper bowl's cut – from 3 m Components: – Front frame; – Rear frame; – Scraper; – 2 wheels; – Laser equipment (laser level head/transmitter, receiver, control panel, cables); – Hydraulic system (hydraulic valve, hydraulic cylinder to lift the bowl/to open left and right side bars of the bowl, reduction device with hydraulic pump, oil filter); – User manual.	$15,450	15%	$13,132.5	20
Laser land level (bucket system) Width of scraper bowl's cut – up to 3 m Components: – Front frame; – Rear frame; – Scraper; – 2 wheels; – Laser equipment (laser level head/transmitter, receiver, control panel, cables); – Hydraulic system (hydraulic valve, hydraulic cylinder to lift the bowl/to open left and right side bars of the bowl, reduction device with hydraulic pump, oil filter); – User manual.	$4,200	10%	$3,780	10

Information about the manufacturer of laser leveling equipment in Uzbekistan:
The «Chirchiqmashagro» company was established in 2012 by the «Chirchiqselmash» factory in order to implement a number of investment projects including the «Organization of modern agricultural equipment production». One of the projects – «Organization of modern laser levels production» – was launched after the adoption of the Decree of the President of the Republic of Uzbekistan № 1758 of May 21, 2012. To date, within the framework of the State program for production localization by the Decision of the President of the Republic of Uzbekistan № 2298 of February 11, 2015, the company has successfully implemented the project in terms of investments and proceeds to a phase of deep localization of production of laser levels that will result in localization rate of over 55% in 2016.

WHERE TO FIND FUNDING FOR BIOGAS PLANT CONSTRUCTION

The GEF SGP has carried out a number of projects aiming to advance the technology of the agricultural waste management to produce energy and valuble organic fertilizers. We have previously talked about the possible gains that can be obtained by converting organic waste into biogas. In this article once again we give a brief overview of the technology and talk about where to get money to build a biogas plant (BP).

Biogas in figures

From 1981 to 2006 **3.8 million** small BPs were built and installed in India. In Nepal, where the population size is the same as in Uzbekistan, there is the national program that supports biogas energy. Thanks to the program **200 thousand** small BPs were built in rural areas by the end of 2009.

China has the largest number of small biogas plants. Interestingly, while in the late 90s of the last century over 10 million plants operated in the country, by 2010 its number has reached nearly **40 million**! This amount of BPs generates about 7 billion m³ of biogas annually, which provides energy to approximately 60 million people. In China the biogas industry employs 600 thousand people.

Uzbekistan is taking its first steps to wide-scale implementation of biogas technologies. According to the unofficial data, currently there are just over 50 BPs of different sizes.

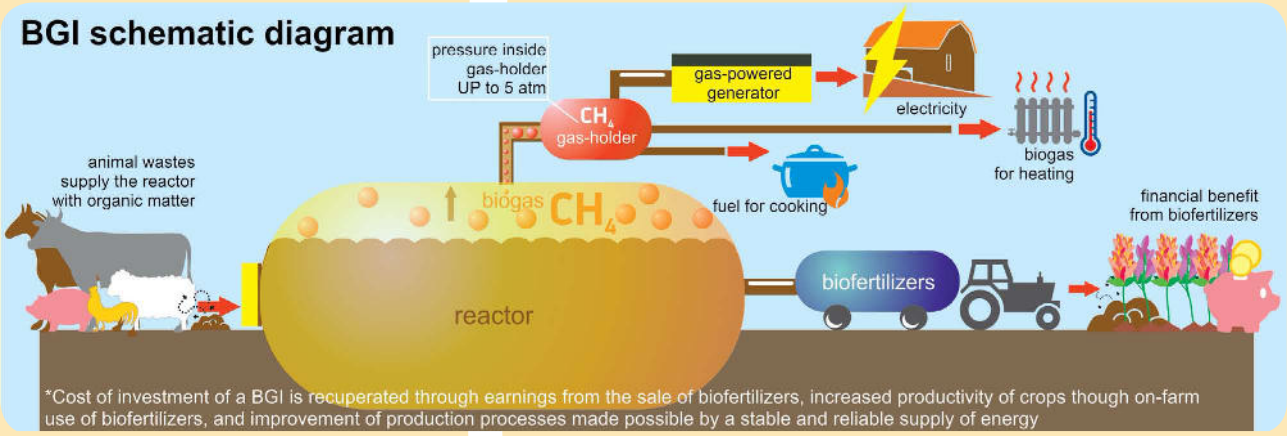
This technology helps to meet a current energy demand of livestock and poultry farms, as well as the demand of the households in remote settlements with a shortage of centralized power supply.

Nowadays, biogas plants can be widely used to solve problems that are mainly related to organic waste management. As a result *biogas* (cheap energy) and an additional product, high-efficiency *organic fertilizer*, are produced.

A calorific value of 1 m³ of biogas, depending on the content of methane in it, is equivalent to the combustion of 0.6-0.8 litres of gasoline, 1.3-1.7 kg of wood or the use of 5-7 kWh of electricity.

Interesting facts about biogas

First biogas train in Sweden
The world's first biogas-powered train is in service in Sweden. The train, which runs between Linkoeping – to the south of Stockholm - and Vaestervik, operates by recycling organic waste. Its route covers the distance of 80 km.
For the present time the train consists of one coach and can carry 60 passengers. In order to develop such a coach, a common type of locomotive Fiat was taken as a basis and its diesel engines were replaced with two gas Volvo's counterparts. According to the constructors, this train is not only environmentally friendly, but also do not require importing expensive oil.



The potential of biogas in Uzbekistan

In 2011:

More than 100 million tons of manure per year

Today:

11.1 million cattle

1 ton = 30 m³ per year → 3 billion m³ = 100 million tons

Manure

4 kWh or 2 kWh = 1 m³ per year → 3 billion m³ = 6 billion kWh or 12 billion kWh

Electricity and Heat energy

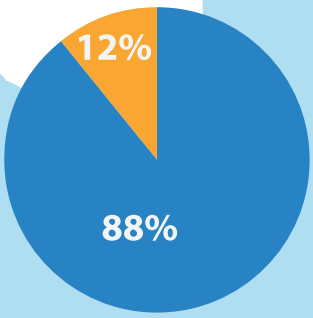
Uzbekistan:

In 2011, Electro stations were generated about 51,4 billion kWh of electricity

6 billion kWh per year produced by bioenergy

Each consumes 1648.146 kWh per year

80 Rank Energy consumption per capita



45.4 billion kWh per year other resources

Can provide 3,640,000.454 more than 10% of the population of Uzbekistan

www.sgp.uz

The result of implementing the biogas technology in many respects depends on accurate calculations and correct technical execution which guarantee the effectiveness of investments.

Every farmer knows that the uninterruptible power supply in agriculture is a key to profitability.

A number of people who wish to implement the adavantageous in many respects technology is growing. But along with the growing interest in the technology, there is a question of where to get the funds for construction.

GEF SGP jointly with the UNDP in Uzbekistan and national partners have made a lot of efforts for the development of the biogas industry in the country. In the period of 2008-2014 a number of pilot projects for the construction of biogas plants have been carried out. They have demonstrated their efficiency and profitability under the current conditions of agricultural sector development. The success of many years of joint work can rightfully be considered in signing of a Decree adopted on November 25th, 2015 by the Cabinet of the Ministers № 343 «On measures to stimulate the construction of biogas plants in the livestock and poultry farms in the republic». In this regard, we want to inform our readers that with the support of the World Bank and the International Development Association (IDA) in Uzbekistan, a project of the Global Environment Facility «Sustainable development of agriculture and reducing the effects of climate change» is being carried out. It is being executed by the Agency for restructuring of agricultural enterprises at the Ministry of Agriculture and Water Resources of the Republic of Uzbekistan. This project supports the development and implementation of technologies for renewable energy sources (RES) in agriculture.

Within the framework of the project **«**Support of agricultural entreprises. Phase 2**»** (http://www.rra.uz/ru/content/project/active/), farms and agricultural businesses can apply for grants and loans for implementation and development of the RES technologies. The grant share is an obligatory part of the loan.

According to the terms and conditions of the project, the funding will be given on purchase of the new equipment and materials only. The proportion of the grant differs yearly. In 2015 of 100 % of the project budget, 60 % comes as a grant from the World Bank, while 30 % is a loan at a preferential rate from the IDA, and 10% – as a contribution of the beneficiary (farmer). In 2016, the proportion will be established as following: 40% – of grant; 50% – of loan and 10% – of contribution of the beneficiary.

The maximum amount of the loan is 500,000 USD, including sub-loan/lease within the credit program of the International Development Association (IDA).

According to the project document, the RES technologies and practices include:

1. Equipment for biogas production (BP);
2. Solar collectors;
3. Production and use of photovoltaic stations;
4. Energy production from biomass;
5. Energy production from wind;
6. Micro hydroelectric plants;
7. Improvement of energy efficiency in agriculture;
8. Use of effective irrigation pumps.

The credit program covers **8 regions** of the Republic of Uzbekistan, such as **Andizhan, Bukhara, Kashkadarya, Samarkand, Tashkent, Syrdarya, Djizak and Fergana regions**.

The commercial banks participating in the program include **«Halk Bank», «Uzpromstroybank», «Qishloq Qurilish Bank», «Turon Bank», «HamkorBank», «Ipak Yuli bank»**.

Credit conditions in the above banks are the same: to obtain credit in Uzbekistan som the loan term is up to 10 years with an interest rate of 10% per year. When applying for a loan in a different currency the credit period is up to 10 years and the interest rate in this case is 5.5% per year.

In order to receive the funds for the construction of BP, farmers should:

At the present time, in a number of areas pilot sites are being established. RES technologies will be tested there and anyone could seek advice to familiarize themselves with the technology. 4 pilot sites with water lifting systems using solar photovoltaic installations have already been created. These pilot sites are located at the farms «Ok suv» in the Andijan region, «Huja Sharofiddin» in the Bukhara region, «Aminzhon Nurly Zamin» in the Samarkand region and «Povulgon Buston» in the Fergana region. At depths between 20-50m, the water lifting system's performance is 50-100 m³ per day. To become familiar with the water lifting systems in pilot areas, one should refer to the regional project implementation group.

1. Contact one of the above-mentioned banks in these regions and verify a possibility of getting the loan.

2. Prepare a business plan on the construction of BP, with regard to the characteristics of the BP's use in your agricultural production. The business plan should include calculations relevant to your specific agricultural production, such as a) return on use of fertilizers on your fields and corresponding crop yield gains; b) sales of the produced fertilizers; c) efficiency of the enhanced energy supply in your agricultural production (better conditions for young livestock, use of energy for greenhouses, use of energy for processing production, and other information on use of the energy obtained from the BP), etc. An example of the business plan for the construction of BP, which is prepared by the NGO KRASS with assistance from the GEF SGP, can be found on the website of the GEF SGP: http://sgp.uz/ru/publications http://sgp.uz/ru/publications/publications/1055.

3. Open a bank account for your farm (enterprise) in a bank that will provide the loan.

4. Along with the business plan, provide to the bank the following documents:

– Main constitutional documents of the farm or enterprise, including a charter and/or a memorandum of Association (and its modifications);

– Property evaluation that was carried out by a licensed company;

– preliminary contract of equipment supply, which is to be acquired through the loan (technical passport of the equipment, its cost, production capacity, etc.).

5. Provide deposit that represents 125% of the total amount of the loan.

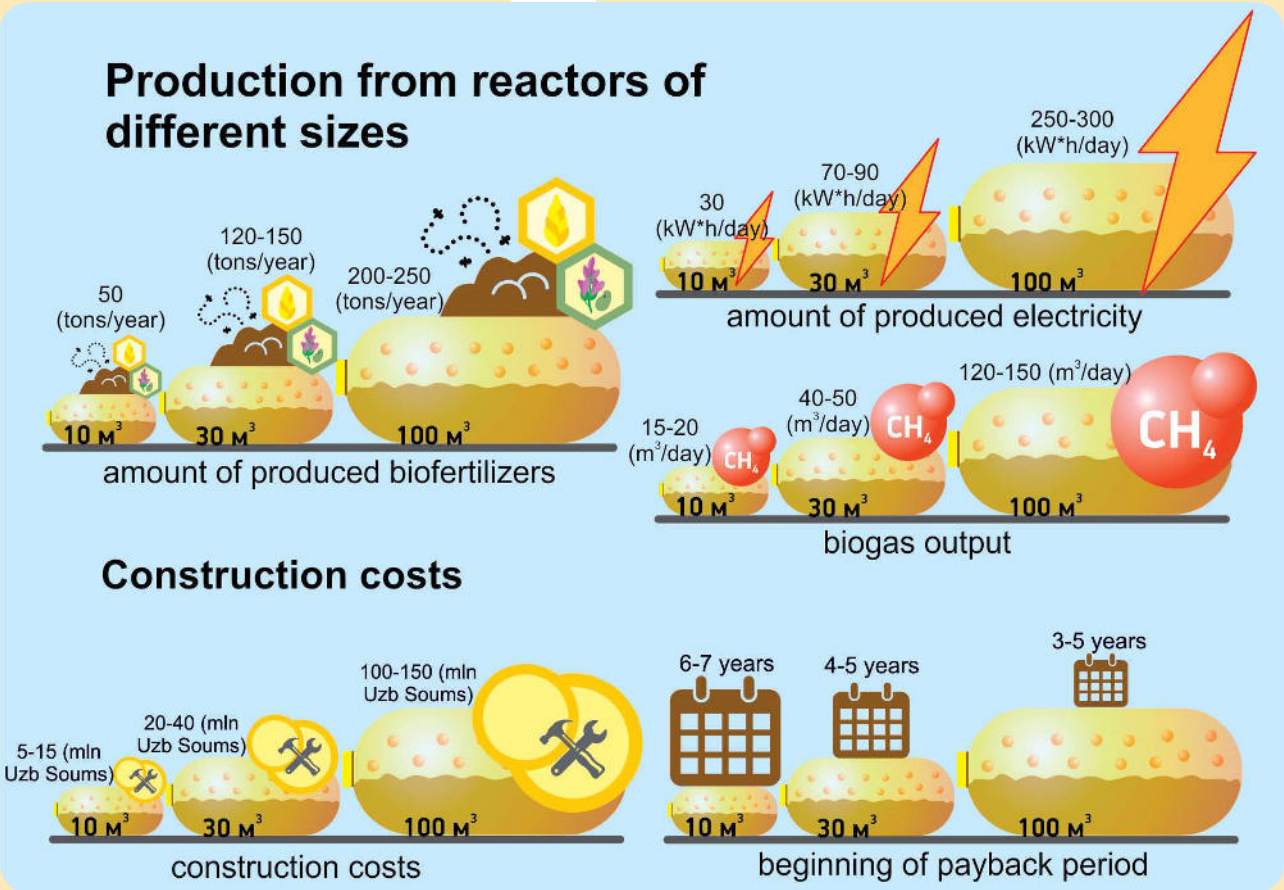
During approval process bank specialists will verify the provided documents on the farm or enterprise.

Thus, farms and agricultural enterprises in these regions will have an opportunity to get funding on acquisition and installation of modern BPs.

A biogas plant can also be built independently with personal funds.

All interested parties can consult the step by step guide-recommendation on construction of a BP «BIOGAS – 11 STEPS TO THE GOAl», which was elaborated within the project of the UNDP and the Government of Uzbekistan «Supporting Uzbekistan in the transition to a Low Emission Development path» (LEDS). This publication is available for download in Russian and Uzbek languages on the website of the GEF SGP: http://sgp.uz/ru/publications and on the website of the LEDS project: http://www.leds.uz/ru/publicationVIE. On the website leds.uz you will also be able to find the database on the farmers who had already built BPs. Surely, you want to find some information on the existing practices before building your own BP.

It should also be noted that when building a BP, you must refer to the State standard of the Repub-



Farmer Vladimir Pogrebennyi in his field with lucerne

lic of Uzbekistan No. O'z DSt 2798:2013 approved by the Standardization, Metrology and Certification Agency of Uzbekistan.

Biogas technology can play an important role in reducing harmful emissions, meet the energy demand of livestock farms and enterprises, **and most importantly become an effective tool for obtaining highly efficient environmentally friendly organic fertilizers. The use of such fertilizers allows you to completely stop applying mineral fertilizers to the soil, as well as to improve soil fertility, and to increase crop yield**.

Why organic fertilizers produced by BP are more efficient than the conventional fertilizers?

A comprehensive answer to this question was given by the farmer Vladimir Pogrebennyi, husband of Nadezhda Durdina, a cattle breeder from Sirdarya region. She has been using successfully a BP of 30 m^3 of volume that was built with the support of the GEF SGP since 2010. *«Biogas is good, for the proprietress and her daily routine. But what is the most important thing here, it's organic fertilizers. We have our own land and on this land we experimented last year. We grow alfalfa for livestock, and the first harvest when we used organic fertilizers was good. The next time we didn't use fertilizers and then the crop yield dropped sharply. If the first time (when we used organic fertilizers) we harvested 3.5 thousand bales, the second time (when we didn't use organic fertilizers) we harvested 2 thousand bales which is by 43% less than the first time. Here is the gain».*

New Heating System for the Facility's Greenhouse at Academy Member F. N. Rusanov Tashkent Botanical Garden

A project on construction of a new heating system for the facility's greenhouse has been launched by the Environmental Resource Centre "EKOMAK-TAB" and the Botanical Garden scientists. This project is unlike others that the Global Environment Facility's Small Grants Programme (GEF SGP) has undertaken. The project does not promote any specific practice except for construction of an energy efficient heating system. The project mostly aims to support scientific and research activities and serve as an example of environmental benefits that can be derived through using of and shifting to modern technologies.

Even though the initial idea for the project was borne two years ago, for various reasons beyond GEF SGP's control, the project was not meant to be at the time. Nevertheless, in 2015, to save a rare collection of plants, the Botanical Garden leadership jointly with GEF SGP resumed efforts to reconstruct and modernise the heating system for the facility's greenhouse.

The species diversity and composition of the tropical and subtropical plant collection at Academy Member F.N. Rusanov Tashkent Botanical Garden is unparalleled in Central Asia. The origins of the collection trace back to the private collection of P.I. Khomutov who served as assistant Syrdarya military governor. Plants also had been acquired from the stocks of the Main Botanical Garden of the USSR Academy of Sciences (in Leningrad) and its various expeditions. The majority of the plants are rare or endangered and cannot be found in natural habitats. The collection serves as the foundation for scientific and experimental propagation of sustainable plant species for indoor landscaping that reflects Uzbekistan's unique climate conditions.

The heating system modernisation was approved by the GEF SGP National Steering Committee and is to completed in December 2015. Now, the greenhouse has an improved and upgraded heating system and modern boilers. The direct outcome of the project, which is key for GEF, is GHGs reduction through reduction in hydrocarbon energy consumption and respective reduction in greenhouse gas emissions. According to preliminary estimates, the reduction in carbon dioxide (CO_2) emissions will represent at least 100 tonnes per year. The final data on energy savings will be provided by the greenhouse scientists at the end of the heating system. Moreover, the project's activities also included roof sealing and insulation, as well as supply of basic office equipment for the greenhouse and its laboratory.

It is hoped that the assistance from the Global Environment Facility will help to preserve the greenhouse's unparalleled plant collection and will improve the conditions of and facilitate the work of the scientists and researchers for the benefit of Uzbekistan's science.

***

Establishment of Plant Micropropagation Laboratory in the Namangan Region

The Global Environment Facility's Small Grants Programme in Uzbekistan has supported establishment of *in vitro* laboratory for plant micropropagation. The lab will produce seedlings of fruit-bearing, decorative and wild trees, shrubs, flowers, etc.

Here is just a small sampling of the benefits that the establishment of such a lab provides:

1. Shortening of the selection process. Since tree graftage inosculation is occurring as early as in the second or third month, seedlings begin to bear fruit two to three years earlier.

2. Accelerated transition of the plants from juvenile to reproductive stages of development. This will facilitate shortening of the time period in which the planting material reaches standard size to just one growing season. Five months following the transplantation from lab containers into the soil, plants reach 40 cm in average height, which is greater than the height of two-year-old seedlings. Depending on the propagation method, by the end of the first growing season, many trees grow under cover from 0.8 m to 1.8 m.

3. Propagation of plants that are otherwise difficult to reproduce through traditional methods. Not all types of plants, and even those during the juvenile stage, can reproduce through seed and vegetative methods with the required success rate (oak, pine, spruce, nut trees, etc.). Thanks to the *in vitro* technology, a large quantity of seedlings of any plant can be grown.

4. Capacity to carry out work year round. As a result of this project, seedlings can be grown at any time of the year.

5. Capacity to automate the growth process. All grafting activities and rooting are conducted with the help of modern specialised equipment, which significantly reduces time.

6. Reduction of space required for growth of the planting stock. Special containers used for seed-

lings are placed on multiple vertically assembled racks.

7. The lab can produce from 10,000 to 15,000 tree seedlings in six months.

The lab will be located in the facilities of the Namangan State University. Interested farmers can order any required plants. The lab has already received an order from the Mingbulak District Khokimyat (administration) for 10,000 seedlings of various trees for forest restoration activities.

The lab telephone number is: + 998 91 363 98 59

***

Establishment of Bird Sanctuary

At the initiative of Yelena Abdullayeva and Pavel Karabayev and with the support of GEF SGP, a bird sanctuary is being established in Tashkent. Prior to the establishment of the sanctuary, youths independently and on their own were helping to care for and release wild birds that had been either found or confiscated from illegal capture.

At the end of 2015, four such «rescue» seasons have been completed saving 331 birds. Until recently, the birds were being cared for in private apartments. Through this project, an aviary has been constructed to house and care for the birds as well as special conditions have been established for production of feed (insects, rodents, etc.) for the birds.

The project is also supported by Uzbekistan State Biological Control and Bird Protection Society. You can learn more about the Sanctuary by following the link to the recently established website: www.swifts.uz.

If you have found or are aware of an injured or illegally captured bird, please call the Sanctuary at the following telephone numbers: +998 90 109 15 04 or +998 90 323 43 26.

***

Future Plans

Small Grants Programme receives funding from the Global Environment Facility to provide grant-making for the benefit of local communities. The funds are distributed by GEF both directly and to the country, which determines the projects to be funded. The Facility allocates funding based on a four-year budget cycle. Presently, the GEF has commenced its sixth budget cycle.

The Global Environment Facility has provided 400,000 USD. The remaining funding was to be provided from funds that GEF allocated to Uzbekistan. However, due to the fact that the entire GEF budget has been already distributed among other large projects, our programme is facing rather dire prospects. Therefore, in the next 2015-2019 budget cycle, the GEF Small Grants Programme in Uzbekistan has only 400,000 USD available for future projects.

To get the most out of the available funding, it has been decided to place focus on projects within a single landscape. NGO ECOSAN has performed for the GEF SGP work on preparation of a project document for the next cycle – the GEF SGP Country Programme Strategy. Please visit our Programme's website for detailed information about the strategy.

Promotion of conservation agriculture has been defined as the key area for the next cycle. Accordingly, in the next four years, the GEF SGP is prepared to support projects promoting practices and technologies that preserve soil fertility, prevent soil degradation, and increase agricultural efficiency thanks to the improvement of the natural capital that has been discussed in this issue.

The main beneficiaries of this project will be farming and rural communities. We invite you to submit to the GEF SGP you applications for projects in this subject area. We look forward to supporting and assisting you in implementation of the projects in this focal area.

GLOBAL ENVIRONMENT FACILITY'S
SMALL GRANTS PROGRAMME
100015, 41/3 Mirabadskaya str., Tashkent
Tel: +998 71 120 34 62
Fax: +998 71 120 34 85
Mob: +998 93 381 00 82
e-mail: alexey.volkov@undp.org
www.sgp.uz

gef

SGP The GEF Small Grants Programme

UNDP Uzbekistan