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Analyses of the Potential Use of Sludges in Forestry and Parks

ANILA KALA[1*], FATOS HUQI[2], FATBARDH SALLAKU[2]

[1]PhD student, Faculty of Agriculture and Environment, Agricultural University of Tirana

[2]Lecturer, Faculty of Agriculture and Environment, Agricultural University of Tirana

*Corresponding author; E-mail: anila_kala@ymail.com

Abstract

Forestry can potentially provide opportunities for using sludge where large areas are available locally to WWTP. Sludge is most useful at the time of planting seedling trees as this improves establishment and early growth; this is particularly important in areas where trees and other vegetation are planted for soil erosion control. Sludge may also be applied to mature forests where the additional nutrients can improve timber yield. However, delivery and application of sludge is constrained by topography as access for vehicles may be difficult and where the land is steep, application by hand may be necessary. The forestry growth cycle is long and nutrient demands may be modest, although they can be high in newly afforested areas as soil are generally very poor, or if replanting is carried out on clear-felled areas as the previous tree crop depletes the soil of nutrients. In intensively managed forestry, the intervals between sludge applications are extended, depending on access, the fertility of the soil, and the growth stage and nutrient status of the trees. The optimum operation window is at (re)planting when the area is open. Sludge can be applied mechanically if ground conditions permit and rates may need to high if the soil is impoverished (up to 50 t ds/ha). Where access is difficult, manual addition of sludge can be made to individual tree plantings, and a few kilograms of sludge should be mixed with the soil for each seedling. Sludge applied at this time has a significant economic benefit as seedling establishment is substantially improved, reducing the costs of replacing failed seedlings.

Keywords: waste; sewage; sludges; heavt metals.

1. Introduction

A potential detraction of sludge application may be a large increase in herbaceous weed growth that could compete with the tree seedlings for light and moisture but this can be controlled by cutting (or grazing if properly controlled) until weeds are shaded out by the trees. There can also be benefits of the additional herbaceous growth in stabilizing soil at risk of erosion; improving the biodiversity of the forest; and availability of browse material for wild animals resulting in higher numbers of game (which may be important where hunting is practiced). Where the gathering of wild food is practiced, signs should be erected to advise people not to pick berries or fungi in sludge-treated areas. After planting, further sludge application is not possible for an extended period as access becomes physically impossible during the 'thicket' stage of growth, and it is only when there is canopy closure, the first thinning takes place and access ways are cut, that it may be feasible for sludge to be applied. For forests under temperate growing conditions, this would generally be about 20 years after planting, depending on tree growth and management practices. An indicative rate of sludge application would be 5 t ds/ha. Subsequent sludge applications could take place at 10 yearly intervals but the frequency should be judged according to need, based on assessment of yield potential and foliar nutrient analysis. Sludge application may be made to established forest at any season of the year, although high rainfall periods should be avoided to minimize the potential risks of run-off and pollution of surface water. Where access is problematic, liquid sludge is usually easier to apply by using hose (by hand or with a retracting reel irrigation gun) but where there are long haulage distances, this is not economically attractive. Dry sludge is usually preferred as this is easier to handle and the potential risks of run-off are reduced. In Albania, forested areas are almost invariably on steep slopes and this means that most forestry activities are done by hand. To use sludge under such conditions will be demanding as

the sludge would have to be placed in containers and carried upslope to the planting locations. Consequently, the use of liquid sludge is not practicable and the sludge should be dry and friable for ease of use. In addition, the forestry workers would be directly exposed to the sludge by handling and the sludge should be treated to minimize its pathogen content in addition to the workers taking normal hygiene precautions (gloves, washing before eating).

2. Material and Methods

Data regarding the forestry surfaces and the categories are analyzed for the Korca and Pogradeci District. Forests cover over 1 million hectares, about 36% of the total area of Albania. Although recent statistics show that this area is relatively stable, production has decreased significantly due in part to illegal cutting over the last decade. Until 1990, the main use was for timber and wood processing but now the predominant use of wood is as fuel for heating and cooking, comprising 45% of total energy demand. Control of over-exploitation of forest resources and illegal cutting for fuel wood are key challenges facing the forestry sector.

The Forest Sector Strategy, adopted in 2007, describes the long-term development of the forestry sector and the contributions of forests to improving social welfare in rural areas. The strategic principles adopted include: sustainable management of forestry and pastoral resources; re-establishment of the environmental and ecological integrity of forests and pastures; and equal distribution of profits/benefits which derive from the use of the forest and pasture resources. The long-term development of the forestry sector and its contribution to improving social welfare will depend in part on the degree to which the sector would benefit from national programmes and financial support. The forestry sector has a high potential to contribute to providing employment through the development of a wide range of products based on renewable wood (e.g. wood for construction, furniture, biomass fuel, etc.) as well as other benefits to the environment.

3. Results and Discussion

The forestry sector is well structure but complex as this covers a range of types of forest as well as grazing land. The majority of the land is owned by the state but there has been progressive transfer of user rights to Communes. The area of forestry land in private ownership is relatively small. National data on the structure of the forestry sector are summarized in Table 1 and the geographical coverage of forestry is illustrated in Figure 1.

Table 1. Structure and Areas of Forestry and Pasture in Albania (2015)

Description	Area (ha)	%
Forests	1,043,717	57.4
High forest	456,710	44
Coppice	326,627	31
Shrub	260,380	25
Grazing in forest	148,185	8.1
Pastures	415,093	22.8
Area with forest vegetation	17,859	1.0
Barren land	77,859	4.3
Unproductive area	115,706	6.4
Total	**1,818,419 100**	

MTE is responsible for forests and associated pastures with management and control functions effected through regional and district forestry offices. These offices also have responsibility for erosion control on the land under their jurisdiction which results from the over-exploitation of forestry, abandoned mines, etc. In addition, MTE is responsible for the national parks and protected areas of environmental and ecological importance, the locations of which are shown in Figure 2. It is understood that there would be no additional restrictions placed on the use of sludge in these areas.

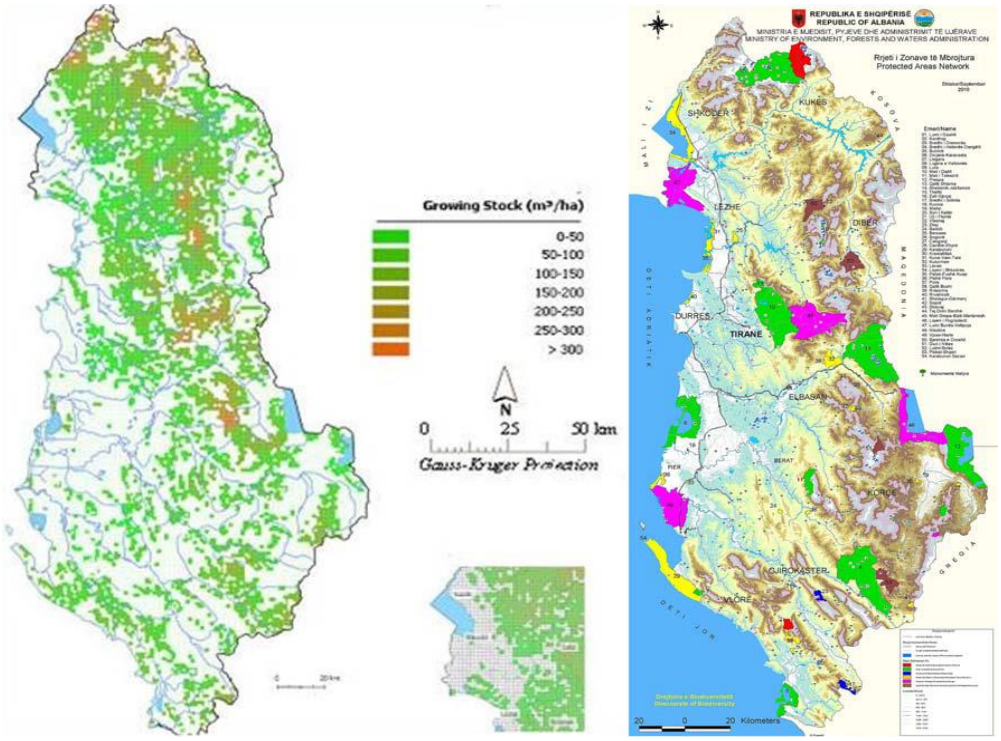

Figure 1. Maps of Forestry, National Parks and Protected Area in Albania

3.1. Forestry Areas

Pogradec District has three forestry sectors covering an area of 28,000 ha, 60% of which is transferred to Communes. The area of forest is 9,120 ha comprising predominantly of chestnut, oak and pine. No planting is carried out in the natural forest areas but tree planting has been done on former mine sites within the watershed of Lake Ohrid for erosion control and further planting is proposed. Pogradec is included in the Pogradec-Prespa protected area (categorised as Protected Landscape) that covers all of the watersheds of Lakes Ohrid and Prespa (Figure 2).

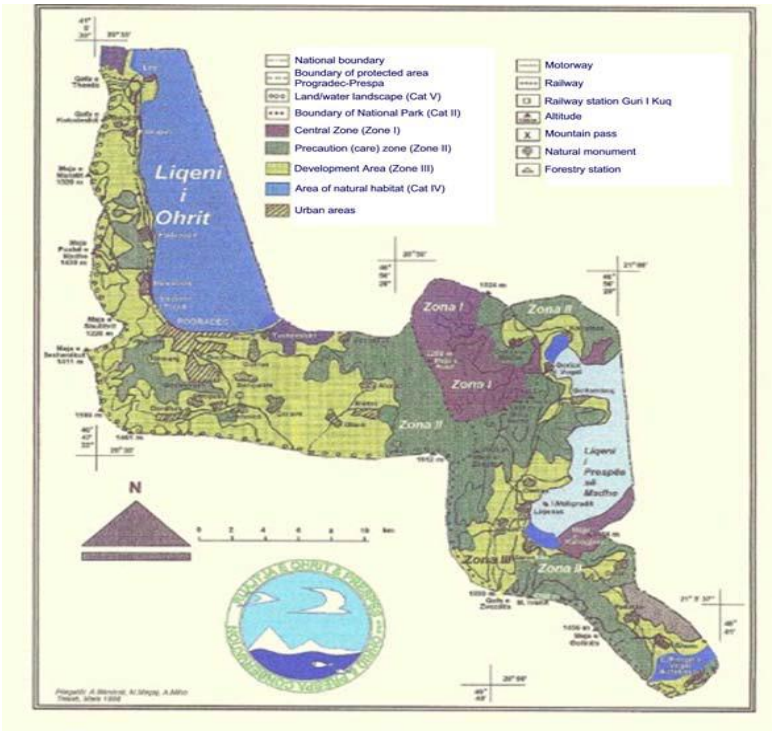

Figure 2. Map of Protected Area Pogradec – Prespa

Korca District has six forestry sectors and covers about 79,000 ha of which 30% is managed by the Communes. The division of forestry and pasture types for the District are summarized in Table 2. Currently, there is no planting or replanting activity due to financial constraints but the District has submitted costed proposals for planting projects in case money does become available (Table 2). The tree planting proposed in Zemblak-Qarr forest economy is relatively close to Korca WWTP and comprises 221 ha.

Table 2. Ownership and Areas of Forestry in Korca District

Type	**State**	**Commune**	**Private**	**Total**
Forest	38,237	19,326	2,729	60,291
Pasture	6,237	3,495	303	10,034
Non-productive	2,638	238	108	2,984
Barren	4,378	270	57	4,704
Other wooded land	507	153	28	688
Water	2	1		3
Total	**51,998**	**23,482**	**3,225**	**78,705**

There is no plans for new tree plantings as there are no areas available, although it was noted that there are large areas of state-owned land that are currently unused (and subject to erosion risk) but are not under the responsibility of the Forestry Directorate. The tree planting season is in late autumn to early spring, according to altitude and climatic conditions. This implies that sludge will need to be stored for extended periods if demand is substantial. Establishing sludge storage close to the area of use would be desirable as this would allow the UK to deliver sludge as it is available. However, unless the storage area is properly constructed to avoid run-off, this is not advisable due to the heavy rainfall during the winter period. Korca has sufficient storage for one year of dried sludge production, and potentially, Pogradec and Kavaja WWTPs have extended storage available in the SRBs. As most tree planting schemes are likely to be small, supply of sludge to meet demand should not be a significant issue, provided that the UKs have advanced warning of likely demand. However, there may be exceptions; if the proposed forestation project in Zemblak-Qarr Forest Economy near Korca does proceed, this could utilize a significant quantity of sludge and the UK should consult with the Korca District Forestry Office over the quantities of sludge that may be required and over what period.

In general, the opportunities to use sludge in forestry depends critically on new tree planting programmes being undertaken as this is the principal opportunity for sludge use. The forestry offices have a positive attitude to sludge as means of improving tree establishment and growth, and thus would help meet their objective of reducing soil erosion in vulnerable areas. However, finance for the forestry sector is limited and few planting programmes are undertaken so it is likely that the potential for using sludge in forestry will be limited and periodic.

While the likely demand for sludge from the Municipalities for urban parks will be small, it would provide an additional outlet and will also allow the Municipalities to save some money in the maintenance of the parks. Despite the abundance of forestry in Albania, the potential for sludge use is very limited as the area of trees planted annually is low. While there is interest in using sludge, the low level of funding available to the forestry sector and the practical problems of supplying sludge to the point of use (most forestry is on steep slopes), is likely to make this outlet of marginal importance generally but may have periodic demand locally.

4. Conclusions

The use of sludge in municipal parks is discounted as being strategically important to the WWTPs due to the small potential demand but sludge may be useful to the Municipalities to save money on alternative soil-improving materials. Reclamation of abandoned mines, quarries, solid waste dumps and the progressive restoration of the planned regional landfills, provides potential one-off opportunities to use significant quantities of sludge. Land reclamation activity is currently low and opportunities are likely to be infrequent and of short duration when large quantities of sludge may be required. The combustion of sludge in cement factories is not

practicable for the WWTPs due to the long transport distances and the lack of development of factories to accept alternative fuels. There is no potential for combustion of sludge in power generation. If a waste-to-energy was implemented for Tirana, this may be considered an option for Kavaja sludge. The option of last resort for sludge is landfill disposal if there are no other or insufficient outlets for beneficial use of sludge. The landfill planned for Maliq would provide an outlet for Pogradec and Korca WWTPs but there is no definite plan for a regional landfill for Tirana. The quantity of sludge is modest in relation to the expected quantities of solid waste, even after allowing for waste reduction through recycling and the the potential need to dispose of sludge to landfill is recognized in the planning of Maliq regional landfill, although no specific allowance has been made in the design. On the other hand, the impact of sludge on the operational life of the landfill would be modest, bringing forward the need for a new landfill by a maximum of two years and much less if the sludge is used as end-of-day cover. The physical properties of the sludges (air-dried and SRB) will be suitable so as not to adversely affect the stability of the landfill body. The final disposal option that may be considered is the construction of dedicated sludge landfills (monofills). This is not commonly practiced internationally but could serve as a shortterm or emergency outlet for when other means of use or disposal of sludge are not available. Such facilities will require construction to sanitary landfill standards and consequently would involve considerable investment. Acceptance of this option in principle and securing suitable sites in practice would be very difficult.

6. References

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