10 Redesigning Forest Policy Tools Under a Transitional Economy Setting

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Introduction

Transition to a market economy implies that forest management (even when conducted by state forestry enterprises) must be conducted in a business-like manner, with the goal of maximizing economic efficiency, and should be independent of the direct influence of authorities (Ferenc, 1995). At the same time, governments or forestry regulatory agencies should set up a framework for forest management that will ensure taking into account societal needs for 'intangibles' produced by forests, i.e. by compensating for market failures. Development of forest policies in European countries shows a clear tendency toward a unified approach to supervision and control of forest management in corporate, state and private forests. Most European countries use a balanced mix of forest policy tools (Merlo and Paveri, 1997) with regulatory tools playing a significant role. Examples of widely used regulatory forest policy tools are restrictions concerning stocking levels, the timing of final fellings, and allowable cuts (Wernerheim, 1988). In this chapter we discuss the regulation of allowable cut within the system of forest policy tools, analyse the current system of annual allowable cuts in the Ukraine, propose a method which will comply with the goals for transition to a market economy, and present implications of its use for timber resources utilization.

Ukrainian Forest Policy

Background

Ukraine is one of the largest European countries in area, size, population, natural resources and economic potential. In size and population it is comparable with France. Ukraine boasts an enviable range of natural resources but nevertheless is seriously dependent on imports of products such as timber, wood, paper and oil. The value of Ukrainian forest resources is estimated as 4.2% of the total value of the country's natural resource potential (Rudenko, 1993). According to the State Forest Cadastre (Ukrderzhlisproekt, 1997) in 1996 the share of forest-covered lands was 15.6% while an optimal figure is estimated as 20–25%. This puts Ukraine in line with those European countries such as Germany, France, Italy and the UK, which are not self-sufficient for forest resources and are net importers of timber and wood products. Forests are unevenly distributed across the country (see Fig. 10.1). The most forested regions of Ukraine are in the north and west, primarily due to climatic conditions. Forests as a source of wood supply play a significant role in the economies of these regions.

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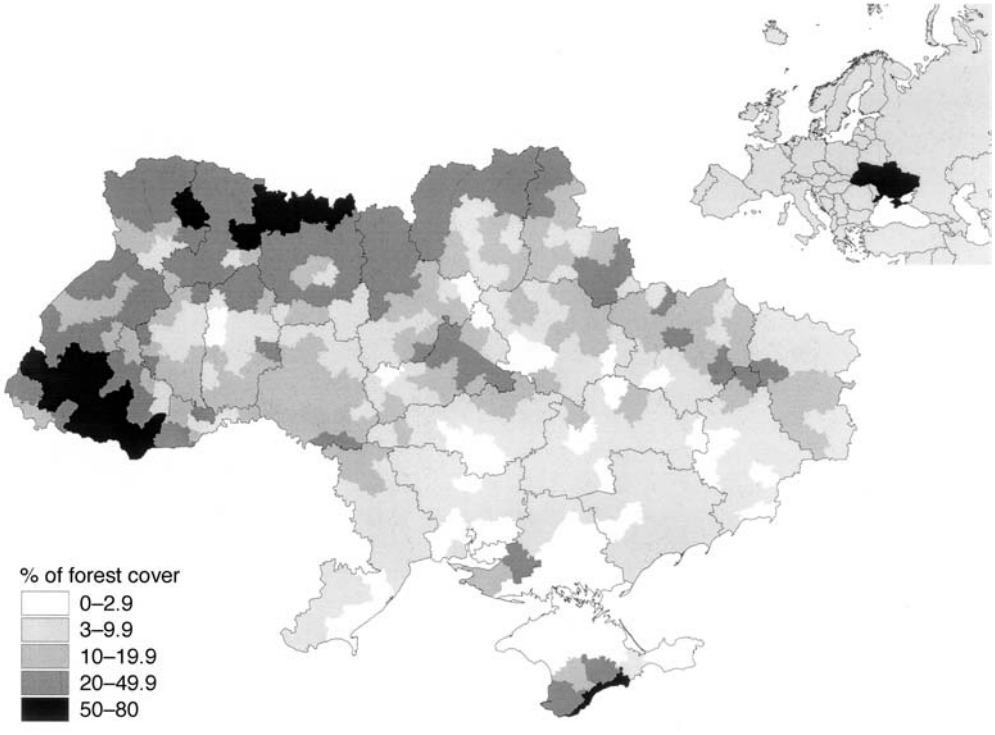

Fig. 10.1. Percentage of forest cover in Ukraine.

Goals and tools

There is no single document detailing forest policy in Ukraine, although the main principles of forest policy are outlined in the Forest Code of Ukraine (Ministry of Forestry, 1994). In particular, it states that 'Ukrainian forests are national assets and they fulfil mainly environmental, aesthetic, pedagogical and other functions, have limited exploitational value and are subject to state accounting and protection'. Other goals, mentioned by Samoplavsky (1997), are:

- an increase of forest-covered area up to an optimal level for every natural zone;
- conservation of the biodiversity of forest ecosystems;
- an increase in forest ecosystems' resistance to negative environmental factors including climate change and increasing anthropogenic load, forest fires, diseases and insect pests;
- rational, inexhaustible use of forests in order to satisfy wood demands of the internal markets of the country;
- amelioration and forest cultivation in the steppe.

Thus, policy goals have been expressed, although conflicts between such statements as 'primary environmental functions of forests' and 'need to satisfy local demand for wood products' are yet to be resolved. Concerning instruments of policy implementation (we will use a classification proposed by Merlo and Paveri (1997)), Ukraine relies mostly on mandatory (regulatory, administrative) and partly complementary (mainly education) tools, almost completely ignoring voluntary (financial-economic and market) tools. This situation is not surprising for an economy in transition. The main regulatory policy tools control harvests in order to achieve a continuous wood supply and provide environmental benefits by zoning, protecting forests in certain areas, and specifying rotation ages, minimal stocking levels and allowable cuts. Because our primary interests are allowable cuts, we will discuss their determination in detail and for analysis purposes will consider other elements as given (i.e. constant).

Current system of allowable cut regulation

According to the Forest Code (Ministry of Forestry, 1994), 'calculated cut' (later – allowable cut) is the annual rate of final fellings. Allowable cut is calculated in the course of forest management planning which takes place every 10 years. It is determined and approved for each permanent forest holder[1] separately within groups of forests and groups of species. It must satisfy requirements of: (i) continuous; (ii) inexhaustible (sustainable); (iii) economically efficient forest-resource utilization; and (iv) maintaining the reproductive capability and high productivity of forest stands and their ecological values (Ukrderzhlisproekt, 1996). In practice, the elementary unit of allowable cuts calculation is the working section[2] within the working part[3] of an individual forest holding. Cuts are calculated for each individual working section on an area basis using a combination of formula methods and applying the restrictions listed above. Sums of cuts, calculated for the working section and converted to volume units, comprise allowable cuts of each forest holder by forest groups and groups of species, as required by the government regulations.

Allowable cuts are subject to approval by the Ministry of Environmental Protection and Nuclear Safety (Ministry of Forestry, 1994; Ministry of Environmental Protection and Nuclear Safety, 1997) and are then aggregated to the level of oblasts[4] and finally to the national level. Annually the Cabinet of Ministers issues an order concerning limits of the 'cutting fund'[5] at the national level and by oblasts and groups of forest holders. These limits determine simultaneously both the plan and the maximum level of fellings and are distributed downwards to the level of each individual forest holder.

Regulatory Tools of Forest Policy

It is assumed that profit-maximizing rational private forest owners/holders in a market economy require higher rates of return on forest capital than the 'social' discount rate and may overexploit forest resources and underproduce amenity services *vis-à-vis* the socially optimal level. Mitigation of such effects is often one of the main goals of state forest policies. Different countries have devised a broad variety of forest policy tools to achieve this goal. Some of these tools, referred to by Merlo and Paveri (1997) as economic-financial, 'aim at convincing people to implement certain measures in exchange for various economic advantages'. The examples are various compensations to the forest holders for the cost of achieving desired social goals, or tax concessions/credits/exemptions, which make certain silvicultural activities (like planting) less economically onerous to the holders. The other class of tools is 'judicial mandatory' or regulatory forest policy tools. These tools are environmental standards and licences, codes of practice, mandatory forestry management planning, restrictions such as annual allowable cut, maximum clearcut area, minimum cut age and prohibition of certain silvicultural practices.

Consistent with the goals of forest policy mentioned above, periodic allowable cut for final fellings should define an upper limit for fellings from the point of view of society's needs for the protective, environmental and other social or amenity functions of forests. The level of harvesting planned by a forest holder (management agent), may be slightly higher or lower in any given year, depending on market conditions and his time preferences. However, the maximum allowable cut determined by the regulatory agency for the planning period (e.g. decade) should not be exceeded.

As mentioned earlier, forest policy implementation in Ukraine relies mostly on regulatory policy tools, which are too restrictive, with almost no economic-financial tools. For many years forest holders (most of which are forestry enterprises) used to work in conditions where almost every strategic decision was directed from the centre, which is inconsistent with the principles of a market economy. Thus, transition will require shifting the emphasis from regulatory to economic-financial tools in order to achieve a more-or-less balanced mix of forest policy tools. This implies, among other things, relaxing, where possible, the burden of 'judicial mandatory' or regulatory forest policy tools, while making sure that the key social objectives of forest policy are not jeopardized.

Before proposing changes to the Ukrainian system of allowable cut regulation, we would like to know how these forest policy regulatory instruments work in countries with market economies. First we restricted our attention to European countries, where, despite the dominance of private forest

ownership, states traditionally impose a number of restrictions on the forestry activities of private forest owners. We found that Swedish forest policy has a similar set of regulations influencing harvests as those found in the Ukrainian system. Namely, Swedish forestry legislation defines restrictions concerning minimum stocking level during the rotation, rotation age and maximum allowable harvest quantities during certain periods (Wernerheim, 1988; Skogsstyrelsen, 1998).

Regulatory forest policy tools in Sweden

Since our primary interest is in harvest rationing, we will first describe this aspect of Swedish forest policy. The Swedish Forestry Act states that 'In order to promote a normal age distribution of forest stands on large forest holdings, the Government, or public authority designated by the Government, may specify the maximum allowable percentage of the forest holding[6] to be felled during a given period' (Skogsstyrelsen, 1994a). First of all, regulation defines the minimum allowed cut age (Skogsstyrelsen, 1994c), and harvested area is limited by availability of stands older than this age. Minimum allowed cut age depends on species, climate zone and site index, and can vary from 45 to 100 years. Additional restrictions concerning allowed cut area apply to forest holdings depending on their size (area of productive forests). For forest holdings exceeding 50 ha, fellings should not result in the area of clearcuts and stands younger than 20 years to become more than 50% of productive forest lands (Skogsstyrelsen, 1994b). For forest holdings larger than 1000 ha, allowable annual felled area (allowable cut) is (i) determined by multiplication of *area of productive forests* by an *area coefficient*, which is the reciprocal of rotation age for dominant site index, and (ii) an *adjustment coefficient*, which reflects the unevenness of the stands' age structure. This adjustment coefficient varies from 1.4 for forest holdings with less than 25% of the forest older than rotation age to 2.8 for forest holdings where the older stands comprise more than 75% of the productive forest's area (Skogsstyrelsen, 1994b). Area, felled during any 5 subsequent years, should not exceed five annual allowable felled areas. In addition to all these restrictions, fellings in any year should not exceed 1.5 times annual allowable cut for forest holdings larger than 5000 ha.

The system is fairly simple and easily understood. As a whole forest policy, it applies equally to all types of forest owners, taking into account differences in size. Because it is designed for a market economy, regulatory tools are working together with other forest policy tools to give forest owners more freedom in choosing among management alternatives than in systems designed for a centrally planned economy.

A summary of the desirable features of the Swedish system that should be kept in mind while redesigning forest harvesting regulations for an economy in transition include:

- the system uses a simple area control method;
- allowable cuts are calculated on the basis of the whole forest holding;
- allowable cuts limit the maximum level of wood harvesting;
- regulation equally applies for all types of ownership; and
- the sizes of forest holdings are taken into account.

Method

Proposed approach to allowable cut regulation

Having said that 'allowable cut' and 'planned cut' should be determined, targeting slightly different goals, we would like to discuss differences in approach to their determination, and propose changes to the currently used system for determining allowable cut in Ukraine.

The requirements for continuous and inexhaustible forest utilization defined by the Forest Code (Ministry of Forestry, 1994) are reasonable from both ecological and economic points of view. But their application to determination of allowable cuts for individual working sections of different sizes can be problematic. This is particularly evident for numerous small working sections, which cannot be regarded as the subject of continuous forest management.

Consider the requirements for an even-flow wood supply from the point of view of the national and regional economies. Important issues here are providing jobs and sustainable timber flows to the

forest industry. Concerning the issue of providing jobs, it is sufficient to ensure an even flow of wood harvest at the regional level, regardless of harvest fluctuations that may occur within individual working sections and working groups.

For the purposes of public forestry regulation, allowable cut levels should be applied regionally to the administrative district or oblast, and not to the working section or working group. The necessity to review the approach to and object of allowable cut calculation was pointed out by Orlov (1928) and Svalov (1969). Recommendations concerning the appropriate unit for calculating allowable cut were given at an FAO seminar devoted to market reforms of the forest sector in Eastern Europe (Ljungman, 1995).

In order to be effective, allowable cuts determination must be non-ambiguous. Determination of allowable cuts according to the current methodology in many cases requires a choice between several options using expert judgement. This might be considered quite reasonable if allowable cut is an instrument of an owner's or holder's forest management plan because it allows the manager to react to changes in conditions such as changes in demand for certain log grades. But such an approach is inappropriate for determination of allowable cuts as an instrument of public regulation of forest activity and state forest policy. Which dimension could be more appropriately used for determining maximum allowable cut? Or, put another way, how should allowable cuts be measured? Rudzkiy (1906) wrote that when raising a question concerning even-flow timber utilization it is impossible to rely on either volume or on quality of timber, and necessary to look for another dimension, more simply understood and easily determined. He suggested that area of annual fellings is such a measure. Although the forest industry is more concerned with the volume of commercial wood, the precision of volume determination is significantly lower than the precision of area determination. Furthermore, different methods are used for volume determination for forest management planning and logging, which lead to deviations including systematic ones. Finally, area is much simpler and can be more reliably supervised *ex post*. Consequently, the most reasonable means of regulating maximum allowable cut, especially in locations where clearcut silviculture dominates, is annual or periodic area cut.

As a final point, we are proposing the following directions of change in the Ukrainian system of regulating allowable cut for final fellings:

- allowable cut should define the maximum area of final fellings;
- the requirement of non-declining yield should be applied for relatively large regions;
- determined allowable cut should be distributed among forest holders proportionally to the availability of mature stands.

Next we describe a method of calculating such allowable cuts, based on data available from Ukrainian forest inventory and forest management planning.

Aggregation

Consider application of the requirements for inexhaustible and continuous use to an individual working section consisting of N age classes K years long, with areas for age classes s_i and rotation age $K \times N$. Age classes are indexed backwards so that s_N represents the area of the youngest class and s_1 the area of 'mature stands' equal to the area of the 'rotation age class' plus areas of all the older age classes. Then for each of N calculated cutting areas L_n,

$$L_n = \frac{1}{K \times n} \sum_{i=1}^{n} s_i \quad 1 \le n \le N \tag{1}$$

will ensure that even cuts flow during the time period equal to n age classes. Equation (1) is the general form of formulae used in practice by forest management planners to determine planned cut area.

Determination of an allowable cut quantity satisfying conditions of continuous non-declining inexhaustible forest utilization can be expressed by:

$$L = \min_{n} \left(\frac{1}{K \times n} \sum_{i=1}^{n} s_i \right) \quad 1 \le n \le N \tag{2}$$

Felling of an area calculated according to Eqn (2) in each future period will assure annual cut to be non-declining and converging to normal as well as ensuring that only mature forest stands are harvested (Komkov *et al.*, 1980). This formula is an analytical representation of a graphical method offered by Abramovich (1960, 1963).

Now let us consider a system of M working sections, where s_i^j represents the area of the ith age class of the jth working section. Komkov *et al.* (1981) have shown that for the system of M working sections with identical rotations $K \times \mathcal{N}^j$:

$$\min_n \left(\frac{1}{K \times n} \sum_{j=1}^{M} \sum_{i=1}^{n} s_i^j \right) \geq \sum_{j=1}^{M} \min_n \left(\frac{1}{K \times n} \sum_{i=1}^{n} s_i^j \right)$$

$$1 \leq n \leq \mathcal{N} \qquad (3)$$

The difference between the left and right sides of Eqn (3) was called the system effect (Δ), which could be greater than or equal to zero. Specifically, $\Delta = 0$, when the working sections composing a system have an even age distribution, or when the age distributions are uneven but identical. Function $F(x)$ is sub-additive when, for all x and y, $F(x + y) \leq F(x) + F(y)$ and the function is called super-additive when $F(x + y) \geq F(x) + F(y)$. Subsequently, the function of non-declining annual cut is sub-additive.

Sinitsyn (1981) and Koryakin (1990) analysed the influence of aggregating management units on the volume of allowable cut. They discovered a positive system effect and concluded that disaggregation within the region could result in loss of the system effect and significantly decrease the level of forest utilization (Koryakin, 1990).

Our method aggregates all the working sections within a certain region with the aim of determining the maximum allowable cut for the region as a whole and then divides it between particular forest holders. The decision concerning the timing and actual level of final fellings within a defined limit is left to the forest holder, who will probably take into account economic conditions, for example, demand for particular lumber and log grades.

The cut rotations and minimal felling ages are different for different working sections, which limits application of calculations shown in Eqn (3) for aggregation of such working sections. But because Eqn (2) leads each particular working section to even-age class distributions, let us assume that

$$s_k^j = \frac{1}{\mathcal{N}} \sum_{i=1}^{\mathcal{N}} s_i^j \quad \text{for} \quad k > \mathcal{N}^j \qquad (4)$$

Now, the maximum area allowed for annual felling for the region may be calculated in the following way:

$$L = \min_n \left(\frac{1}{K \times n} \sum_{j=1}^{M} \sum_{i=1}^{n} \begin{cases} s_i^j, & \text{if} \quad i \leq \mathcal{N}^j \\ \frac{1}{\mathcal{N}} \sum_{k=1}^{\mathcal{N}} s_k^j, & \text{if} \quad i > \mathcal{N}^j \end{cases} \right)$$

$$1 \leq n \leq \max_j \mathcal{N}^j \qquad (5)$$

This method will allow calculation of the non-declining maximum annual felling area for the whole administrative region, where the forest is held by numerous forest holders, and each holding is divided into several working sections with different rotation ages. Once calculated for the region, a proportionate distribution of the allowable cut among forest holders can be done based on the availability of mature stands.

Data

We examined the influence of the system effect on the calculation of maximum allowable cut for final fellings in Vinnyts'ka and Sums'ka administrative oblasts (see Fig. 10.2).

The data used were a subset (covering these oblasts) of the State Forest Inventory (Cadastre) of 1996. The State Forest Inventory (Cadastre) covers forests of all holders, but data are aggregated and, in particular, contain information on age structure as age group distributions. Age groups consist of several age classes and the length of an age group can vary from 10 to 60 years depending on species and rotation age.

The proposed method requires area distribution by equal age classes for all the working sections. Since the most common length of an age class is 10 years, we attempted to convert age group distributions contained in the State Forest inventory to 10-year age classes, assuming equal age distribution within age groups. Furthermore, only those stands where final fellings are potentially allowed were included in the calculations (66% for Vinnyts'ka and 72% for Sums'ka oblasts, see Fig. 10.2).

Results

In order to evaluate the influence of the proposed method on future harvests, allowable cuts for the two administrative oblasts were calculated for the first 10-year period according to several methods

(see Table 10.1). Calculations for the first four of the allowable cut determination methods presented in Table 10.1 (a–d) were done for each individual working section and summed to obtain the allowable cut for the oblast.

The first three methods are not currently used in the practice of forest management planning; here they were used for historical reasons and to provide insight about the age class structure of the forests. 'Even cut' (Table 10.1a) is calculated by dividing the area of a working section by rotation length. 'Maturity cut' (Table 10.1b) is calculated by dividing the area of mature and over-mature stands of a working section by the length of planning period (10 years). Non-declining cut (Table 10.1c) is allowable cut calculated according to Eqn (2), which assumes non-declining yield for each individual working section.

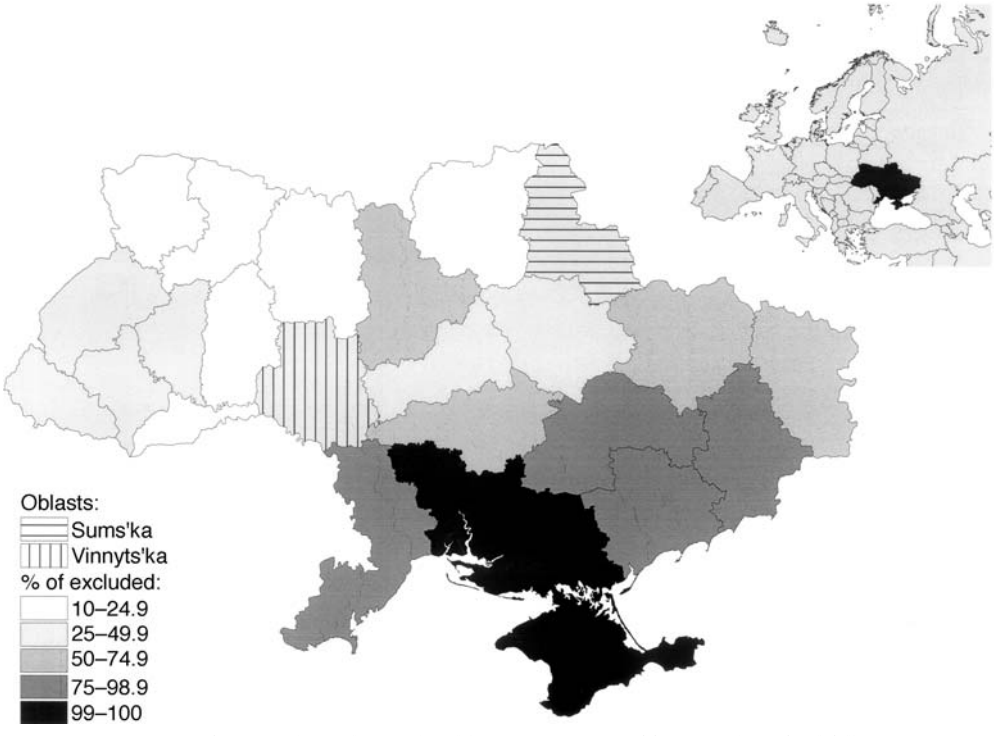

Fig. 10.2. Location of Vinnyts'ka and Sums'ka oblasts; percentage of forests, where final fellings are not allowed.

Table 10.1. Calculation of annual allowable cut for 1997–2006 by different methods and with different levels of aggregation (thousand ha).

		Oblasts	
No.	Parameters	Vinnyts'ka	Sums'ka
1	Sum of cuts calculated by individual working sections		
	(a) 'even cut'	2.27	3.22
	(b) 'maturity cut'	2.12	1.62
	(c) non-declining cut (2)	0.88	1.05
	(d) allowable cut according to the currently used method	0.90	1.36
2	Non-declining cut for aggregation of working sections to the oblast level (5)	1.77	1.62
	System effect	97%	19%

Allowable cut according to the method currently used in forest management planning in Ukraine (Table 10.1d), is calculated similarly to the 'non-declining cut', with the exception that it allows final felling of the ripening stands approaching maturity for some species in certain age structures. The last method shown in Table 10.1 is allowable cut calculated according to the proposed method, which assumes non-declining yield for the aggregated working sections within an oblast. The system effect was calculated as the difference between results obtained using the proposed and currently used methods.

The sum of 'even cuts' and the sum of 'maturity cuts' are given to provide information about the harvest potential of forest resources in the regions. They represent long-term sustained yield and availability of mature stands, respectively. It is evident from comparisons of the sum of 'even cuts' with the sum of 'maturity cuts' that there is a deficit of mature stands. The sum of 'non-declining cuts' by the individual working sections is less than the sum of 'maturity cuts', which indicates the existence of bottlenecks in the age class structure rather than simply a deficit of mature stands. The unevenness of the age class structure of specific working sections is different and is reflected in the existence of a positive system effect – the aggregated 'non-declining cut' is higher than the sum of 'non-declining cuts' calculated at the individual working section level.

To test the impact of introducing the proposed method, we projected the dynamics of the forests of two oblasts using both the currently used method and our proposed method. The assumptions used for the projections were that the land base does not change, all allowable cut is felled and immediately regenerated, and regenerated area remains in the current working section. Results are shown in Figs 10.3 (Vinnyts'ka oblast) and 10.4 (Sums'ka oblast). The left and right diagrams show the dynamics of 10-year allowable cuts (assumed to be equal to the harvests) as well as the dynamics of the mature and over-mature inventory under the currently used and proposed methods, respectively.

Both figures show that the proposed method allows for achieving a level of sustained yield harvest faster while allowing higher levels of harvesting in the first periods.

Discussion

The forest policies of all nations evolve over time in response to socio-economic changes and changes in society's attitudes about the environment in which they live. Ukraine, like a number of countries in Eastern Europe and Asia, is in the midst of transition to a capitalist economy. With a different incentive structure in place and a

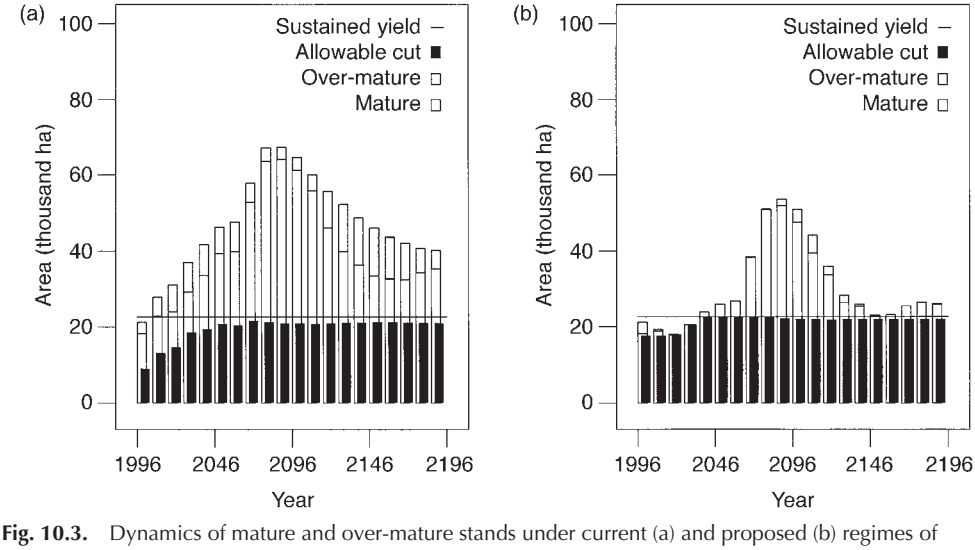

Fig. 10.3. Dynamics of mature and over-mature stands under current (a) and proposed (b) regimes of determination of allowable cuts for Vinnyts'ka oblast.

national focus on socio-economic development, changes in basic forest policy tools can yield a more efficient and sustainable forest industry while providing significant safeguards regarding overexploitation and consequent impacts to ecosystems.

The results of implementing the changes recommended here for determining allowable cuts are the potential for more efficient utilization of mature stands and a faster approach to the even-cut or long-term sustained yield level (both of which are good for economic development). A consequent environmental benefit is the resulting even-age structure for the forest, which has always been a goal of traditional forest management and is considered by many to be more environmentally friendly.

A tool has been developed which, when applied to the regulation of timber utilization in the region, will satisfy two requirements: (i) continuous and (ii) inexhaustible (sustainable) use of forest resources. The forces driving rational profit-maximizing producers under conditions of a market economy will secure the requirement of efficient utilization of forest resources. The management alternatives, including the composition of stands, thinning regime, cut age and intensity of timber utilization are chosen with a focus on profit maximization. The key factor for decision making concerning management alternatives is the rate of return on capital. The rate required by private individuals, organizations and firms, is generally higher than that of society as a whole. In forestry this is reflected in the fact that the socially optimal rotation is, *ceteris paribus*, longer than the privately optimal one, and that the socially optimal intensity of timber stock exploitation is lower than the privately optimal one. Consequently, conducting forest management under conditions where rotation age is limited from the bottom and intensity of exploitation from the top, according to the socially optimal parameters, rational forest users will approach the allowable cut level defined by Eqn (5). This will satisfy the requirement for rational utilization of the existing stock of mature stands.

Conclusions

We proposed enhancement of only one of the tools in the Ukraine's system of harvest regulation. The method proposed was based on the assumptions of strong requirements for non-declining harvests and an existing system of rotation ages, both of which are based on political decisions. Our method allows for the relaxation of the non-declining harvest requirement in two ways: by separating rotation age and minimum cut age, and by assigning lower weights to the age classes which will be harvested in the distant future. Rotation ages are a controversial issue of forest policy deserving attention. Many economists agree that in many cases they are too long and this question

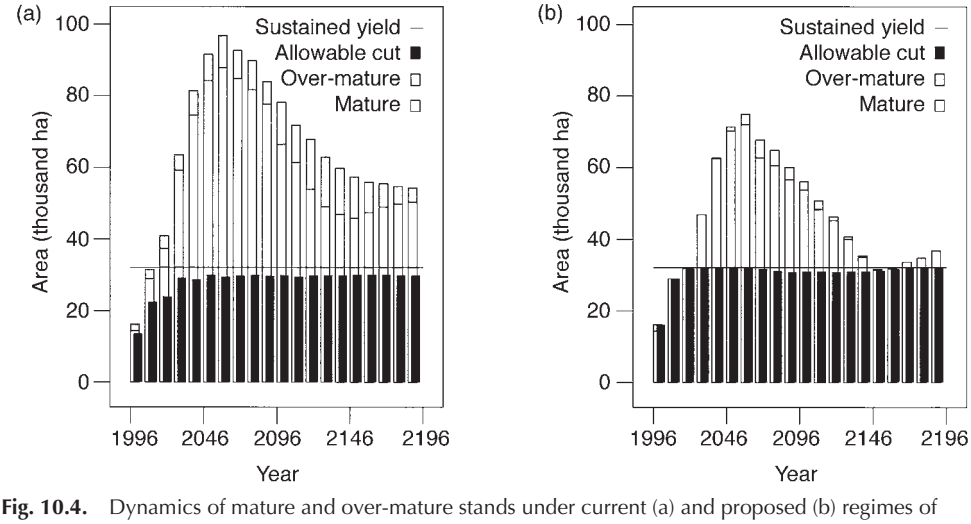

Fig. 10.4. Dynamics of mature and over-mature stands under current (a) and proposed (b) regimes of determination of allowable cuts for Sums'ka oblast.

should be investigated within the context of other forest policy goals using economic techniques.

The system of incentives common to most market economies should replace the system of incentives inherited from the previous command-administrative economy. Our method assumed that forest owners/holders are rational and interested in maximizing profit/return on capital. So far, forests cannot be privately owned in Ukraine, in fact they are not considered financial assets. This is another problem that will require the attention of economists and policy makers in the future as Ukraine progresses in its transition to a market economy.

Endnotes

[1] According to the Forest Code, all the Ukrainian forests are property of the State. The Supreme *Rada* (Parliament) and local *Radas* have forests at their disposal on behalf of the State. These *Radas* within their competence can grant forest parcels for permanent use (Article 6). Forest parcels can be granted for permanent use to specialized forestry enterprises or other enterprises having specialized subdivisions. About 66% of Ukrainian forests are in the permanent use of the state forestry enterprises reporting to the State Committee of Forestry (formerly Ministry of Forestry).

[2] 'Working section' is a spatially distributed set of forest stands of different ages but with similar silvicultural characteristics, e.g. species, rotation age.

[3] 'Working part' is a spatially delimited area with similar economic conditions and goals of forest management.

[4] Ukraine is divided into 24 administrative oblasts and the Crimean Autonomous Republic. Each oblast is divided into 11–37 administrative districts.

[5] 'Cutting fund' is the amount of standing timber available for final harvesting.

[6] Forest holding shall be defined as that forest land which is located within the borders of one municipality, and held by one and the same owner (Skogsstyrelsen, 1994b).

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