Sustainable forest management as experimental study from the Czech and Slovak Republics.

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Abstract: Different forest property regimes based on individual, collective or state ownership co-exist in various countries as a result of their institutional evolution in the past. The government regulation of forest management goes across all property right structures. Empirical studies and theoretical discussions try to reveal sustainable forest property regimes that would balance both use and protection over time. The aim of the paper is to complement this research agenda by comparing the behaviour of owners within an individual property regime and owners within a common property regime. The comparison is done via field experiment within which players express their preferences toward harvesting of a hypothetical forest. The experiment was carried out in two post-socialist countries – the Czech and Slovak republics. The results of the experiment revealed the higher sustainability of owners within common property regimes which has been proven by numerous scholars. The research also highlighted the importance of communication and informal rules between stakeholders and agents concerning the management of a common pool resource.

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1. Introduction

Common pool resources (CPRs) are defined as natural and manmade resources in which the exclusion of beneficiaries through physical and institutional means is especially costly, and exploitation by one user reduces resource availability for others (Hardin, 1968; Ostrom et al., 1994 and others). This creates potential social dilemmas within which individual short-term interests conflict with the long-term interests of society. Traditional approaches to address these CPR dilemmas come from the theory of property rights. The concept of property rights in resource management is originally understood as the right to sell or alienate harvesting rights (Demsetz, 1967). In this view, users who could not sell had no property rights. In the last 30 years, a number of studies have provided empirical evidence that ownership encompasses the full set of rights, including access, withdrawal, management, exclusion and alienation (Schlager, Ostrom, 1992; Ostrom 2010). This new concept of property rights increases the importance of user rights and management practices. Thus, the concept of a property regime consisting of user rights and management rules in use, is seen as a vital approach to studying the sustainability of natural resource management (see e.g. Brunckhorst, 2000; Degnbol, McCay, 2007; Paavola, Adger, 2005; Trawick, 2001; Ostrom, 2010; Kluvankova-Oravska, 2011.).

The concept of a property regime also contradicts with the original theoretical suggestion that private or centralized state management are the only viable policy solutions to prevent resource degradation (as presented in Gordon, 1954 and Hardin, 1968). There are disputes, based on both theoretical and empirical evidence, over the optimal or robust property regimes that would balance the use and protection of the resource in question (Berkes et al., 2004; Andersson, Ostrom, 2008; Pulhin, Dressler, 2009 or Poteete et al, 2010). There is an increasing belief among social scientists that natural resources that have been managed under common property regimes in the long-term can lead to more sustainable management practices (Quinn et al., 2007; Ostrom, 2006). Common property regimes, if based on long lasting institutions of self-management and self-governance are seen as more effective institutions (Ostrom, Nagendra, 2006). Forest property regimes based on collective ownership have become one of the centres of research interest (see e.g. Kluvánková-Oravská, 2011; Webb and Shivakoti, 2008; Wollenberg et al., 2006 among others).

The aim of this paper is to complement the discussion by comparing the behaviour of forest owners within an individual property regime and common property regime. The key hypothesis is whether long lasting institutions of a common property forest regime lead to more sustainable behaviour than individual ownership or vice versa. We assess the hypothesis by using field experiments. These experiments were originally developed and applied by a group of researchers in Colombia and Thailand (see Cardenas et al., forthcoming). Therefore, we repeat their approach in a different historical and territorial environment and enlarge the experimental focus by including the effect of communication (see the detailed description of the method in section 2).

The second section describes the evolution of individual and common forest property regimes in two post-socialist Central European countries – the Czech Republic and the Slovak Republic. In the next section, we present the methodology, the design of the field experiment and the structure of the data gathered. In the fourth section the results and discussion are presented. Finally, conclusions are drawn to address issues of further research and policy.

2. Evolution of Forest Property Regimes

The section maps the historical evolution of forest property regimes in the selected territory over the past two centuries. We intend to show that there are only minor differences to these states, which were both part of one empire or republic for most of the time.

2.1. Brief History of Land Reforms

Forestry has traditionally been a strong branch in most Central and Eastern European countries. The long history of Austro-Hungarian forest management dates back to the 16th century with legal regulation originating in 1754 and 1879, enabling the establishment of state territorial administrative structures for forestry, which had well-developed long-term management plans by the end of the 19th century (Trifunovová, 2010; Kolbert and Balasz, 2010). In that time forestry development was also driven by utilitarian values to supply traditional mining activities. The regulation and protection of forests from the mining industry

was initiated by the Austrian Forest Law (No. 250) from 1852 (1857 in the Hungarian part) and systematically regulated usufruct rights and established state control over forests. In 1879 the first obligatory forest management plans came into force (Řezáč, 2001).

With the fall of the Austro-Hungarian Monarchy at the beginning of the 20th century, about 80 % of forests were in private ownership, to a large extent owned by the aristocracy, but also by towns and the bourgeoisie (Oliva, 2006). In 1918, after World War I, a new state – Czechoslovakia – implemented land reforms to prevent post-war exploitation of forests and by the Law on Conquest (No. 215/1919) limited maximum private forest tenure to 250 ha. Thus large portion of forests (originally in the hands of the Austro-Hungarian and the opposing German aristocracy) was assigned to the Czechoslovakian state. Financial compensation was provided to owners, but pre-war prices were reflected and high inflation depreciated them (Oliva, 2006). Land reforms continued after World War II in 1945 and 1948 respectively, when most forests were confiscated by the socialist regime (Act No. 46/1948), – this process affected individual owners as well as various non-state entities, such as co-operatives and other forms of common property regimes. The nationalization of forests was completed in 1958 (UHUL, 2009). As a result of democratisation after the political transformations of 1989, the private property renewal (restitution) process was initiated. Most forests were returned to their original owners.[1]

In 1993, Czechoslovakia separated into the Czech Republic and the Slovak Republic, keeping several common management practices but also creating differences in policy and governance. Presently, the main difference between the Czech and Slovak republics is in the structure of forest ownership – specifically the representation of state ownership, which is much higher in the Czech Republic (61.5 %) compared to the Slovak Republic (41.4 %). Further, the Slovak ownership structure contains a special form of the common property regime the "urbars", which hardly exists in the Czech Republic (see sections 2.2 and 2.3 for a detailed description).

[1] Property has not been returned to people that collaborated with the Germans during World War II. The process of restitutions has not been finished, yet, and there are numerous lawsuits going on.

Table 1, Ownership structure of forests in % in 2007

Ownership (in %)	**Czech Republic**	**Slovak Republic**
State	61.5	41.4
Individual	21.3	14.3
Municipal	15.9	9.8
Common (mostly urbars)	n.a.	25.5
Others (the Church, forest	1.3	3.4
Unknown	-	5.6
TOTAL	**100.0**	**100.0**

Source: MZE, 2008; MP, 2008

2.2. Individual Property Regime

Individual private forest ownership is prevalent in the Czech Republic. The large number of small owners (3 ha and less) require the careful coordination of neighbours' activities. Forest management plans are issues for all forest units for the period of 10 years and provide the necessary guidance on harvesting and forest protection. Harvesting requires prior approval by the state authority. Access to the forest is public, some user rights are, however, regulated or prohibited (e.g. noise, fire, smoking or driving motor vehicles, etc). Forest owners are allowed to carry out monitoring (Forest Law, 1995).

2.3. Common Property Regime

In the Slovak Republic a significant share of forests belongs to the common property of the "urbars". They constitute a form of self-governed, historical land co-ownership regime, mainly of forested land and pastures, usually within one village.

After the abolition of serfdom in 1848 ownership of those pastures and forests was transferred to them in the form of common property; today, the majority is situated within national parks. Urbars followed in the wake of the forest decree from 1767 (called the Teresian decree) to manage wood as a strategic resource for the mining industry but also to protect forest from overexploitation by overgrazing, illegal timber and inappropriate land use changes (Nozicka, 1956). More than 40 years of regime disconnection and land nationalization since 1948 has resulted in significant fragmentation of shares to sometimes less than 1 ha and the erosion of local institutions (Kluvankova-Oravska, forthcoming). Urbars were re-established in the

process of land restitution by Act No. 181/1995 on Land Associations.

Today, the main decision-making body is actually an assembly of owners, which collectively decides on cost benefit sharing, votes for the management committee and adopts an annual economic strategy (Act No. 181/1995 on Land Associations). Urbar land cannot be sold without the consent of all shareholders and property in the urbar is inherited from parents to children. Urbars operate on ten-year programmes designed and controlled by the state forest authority. Timber, replanting and other activities are planned for this period and each subject has a certain flexibility to decide on the strategy for each year. Social equity is also used as a reason behind decision-making (interview with urbar leaders). Further, urbars can adopt voluntary monitoring of members or other forest users or invest private costs into informal sanctioning. The flexibility and local experience creates conditions for renewing long-lasting institutions that have demonstrated their ability to adapt to external factors.

3. Material and methods

The theory of property regimes largely relies on empirical qualitative case studies. These are criticised for overestimating the uniqueness or generality of particular cases known as internal validity (Sartori, 1991; Poteete et al, 2010; Janssen et al., 2008). A novel approach to overcome the methodological challenges and validity of qualitative studies is to employ behavioural approaches. Experimental methods offer the possibility to test a replicated decision making situation and the effect institutional innovations have on behaviour under a controlled situation (Ostrom 1998; Janssen 2008). Experiments related to the collective action of the commons represent a form of social dilemma where human subjects face a situation in which private interests are in conflict with group interests (Poteete et al, 2010). Experiments usually conducted in laboratory conditions are becoming criticised for the abstract nature of decision making, the limited subject pool, the small incentive and self-selection of subjects (Cooper, 2006; Levitt, List, 2007a, 2007b, 2008; Ahn et al., 2010) known also as the external validity of laboratory experiments. Thus, there is a growing interest in experimenting with real decision making subjects in the field in an effort to overcome the validity problems of laboratory experiments and case study approaches (Slonim and Roth, 1998; Cameron, 1999; List, 2004; Carpenter et al., 2005, 2007; Cardenas. 2001; Cardenas et al., 2004; Cardenas et al., forthcoming, etc.).

In our paper we use field experiments to compare the behaviour of two groups of forest owners – those who own a forest individually and those having a share in the common forest (urbar). In particular, we test the hypothesis that the common property regime represent a more sustainable forest governance. If so, urbar members should be capable of more sustainable resource use than individual forest owners (see the rules of the experiment below). Here sustainability is understood as harvesting an amount that is equal or close to the natural renewal of the resource.

The field experiment was originally developed by Cardenas et al., (forthcoming) and was initially applied in Colombia and Thailand. It was later replicated within the European Marie Curie Research Training Network "GoverNat: *Multi-level Governance of Natural Resources: Tools and Processes for Water and Biodiversity Governance in Europe*". A novel and challenging element of field experiments with CPRs is to address ecosystem institution fit (Young, 2002) by including ecosystem dynamics into the game design (Cardenas et al., forthcoming). The experiment in this paper not only includes ecosystem dynamics but it was further developed by the authors so as to address the effects of communication.

A new generation of field experiments with CPR considers communication as a key factor of cooperative behaviour to reduce harvesting (Janssen et al., 2010). For example, the meta analysis of more than 100 experiments, showed that communication increased cooperation in about 45 % (Sally, 1995). The positive effect of face-to-face communication in a CPR dilemma was further explored by a number of studies (Ostrom, Walker 1991; Ostrom et al., 1992, 1994; Ostrom, 1998). These studies provided empirical evidence that rather than subject demographics or self-selection in the experiments, communication and the capacity for self governance significantly increase the effectiveness of long term natural resource management.

3.1. The experimental design

The original experiment consisted of two *stages* each having 10 *rounds*. The scenario requires individual harvesting of trees from a limited common pool (forest) that regenerates slowly depending on the number of trees remaining at the end of each round. The game starts with 100 trees (m^3) of wood. The target of the players is to get as many trees as possible given a technical maximum of 5 trees per player per round. Harvest is reimbursed in cash at the end

of the game. The fee was calculated on the basis of comparable income (across geographical borders) if aggregated to the total game income per player as an average amount equal to two days of work. The experiment involves a typical social dilemma concerning a depletable CPR. Although each individual makes their harvesting decisions secretly without being allowed to communicate with other participants, the decisions indirectly influence the common resource, reducing the size of the forest and thus the harvesting pool for the next round. The game may very well end up with the absolute depletion of the resource, illustrating a typical tragedy of the commons (Hardin, 1968).

In the second stage of the game, a rule is voted on – again secretly and without any interaction among the players – and implemented. The applied rule regulates harvesting, either by setting a maximum harvesting limit on the players, by rotating the harvesting players or by allocating harvesting rights randomly, in a lottery style, to different players each round. Breaking the rule is possible, but includes a certain risk of inspection (1 out of 6). In such a case, the illegal harvest is confiscated and an additional sanction is imposed on the cheating player.

The forest experiment design employed in this research involves a third stage of the game, within which communication among the players is allowed every second round. As such, subjects discuss face-to-face the rules to be implemented, customise an existence rule or invent a completely new rule. Furthermore, the subjects decide on the sanctions and jointly decide on any modifications they desire, with no formal enforcement. This arrangement allows for self-governing.

The experiment also includes the feature of ecosystem dynamics. Stock effects and spatial effects are issues that ecologists and economists have studied in forests, fisheries or watershed management, although experimental works on these ecological aspects are rather scarce (Cardenas et al., forthcoming). This represents an innovative feature in CPR experiments and aims to contribute to the complexity and interdisciplinarity of the research. In the forestry game presented here, ecological dynamics are represented by the re-growth of trees at a certain rate, aimed at describing and better aligning the co-evolution of certain ecosystem and institutional characteristics (in each round, after extraction, every 10 standing trees will yield one more tree that is available to the group for extraction).

3.2. Data Description and Analysis

In total 75 subjects participated in the game. Eight games were undertaken with individual owners in the Czech Republic, and seven games with members of urbars in the Slovak Republic. Table 2 shows group specific data gathered during games with notation SK1-SK7, as denoted "SK URBAR"; individual private forest owners in Czech Republic, data denoted as CZ1,2,5-8 constitutes small owners with forest size 2 ha on average, it is named as "CZ SMALL OWNERS", and groups denoted as CZ3-4 are owners with forest around 20 ha which are called "CZ BIG or LARGE OWNERS".

The territories for games neighbored with nature protection areas. Group members (subjects) were selected on the local level within a scale of a single village. The following requirements were met: a) an owner of the forest (or an urbar member) with direct linkage to resource management, b) only one member of a family.

After the experiment, all subjects participated in semi-structured interviews to find out the demographic characteristics, the reasoning behind individual behaviour and the experimental design's similarities to a real decision making situation. In cases where a group was homogeneous and able to respond collectively, a focus group discussion was undertaken instead of individual interviews (five groups). Additionally several semi-structured interviews with forest stakeholders in the Slovak Republic where used to describe the evolution of urbars and the behaviour of forest actors.

Table 2, Overview of forestry game groups

Group	**Country**	**Ownership**	**Average age of players**	**Average size of forest ownership per individual or urbar**
CZ 1 (INDIV 1)	Czech Rep.	Individual	40.6	1.46
CZ 2 (INDIV 2)	Czech Rep.	Individual	56.4	0.9
CZ 3 (INDIV 3)	Czech Rep.	Individual	39.4	7.3
CZ 4 (INDIV 4)	Czech Rep.	Individual	47	22.8
CZ 5 (INDIV 5)	Czech Rep.	Individual	58.8	1,6
CZ 6 (INDIV 6)	Czech Rep.	Individual	62	2,1
CZ 7 (INDIV 7)	Czech Rep.	Individual	64.8	5
CZ 8 (INDIV 8)	Czech Rep.	Individual	50.4	3.8
SK1 (URBAR 1)	Slovak Rep.	Common	55	250
SK 2 (URBAR2)	Slovak Rep.	Common	50	310
SK 3 (URBAR 3)	Slovak Rep.	Common	53.8	300
SK 4 (URBAR 4)	Slovak Rep.	Common	55	312
SK 5 (URBAR 5)	Slovak Rep.	Common	46	4 349
SK 6 (URBAR 6)	Slovak Rep.	Common	48	902
SK 7 (URBAR 7)	Slovak Rep.	Common	53	680

Source: authors

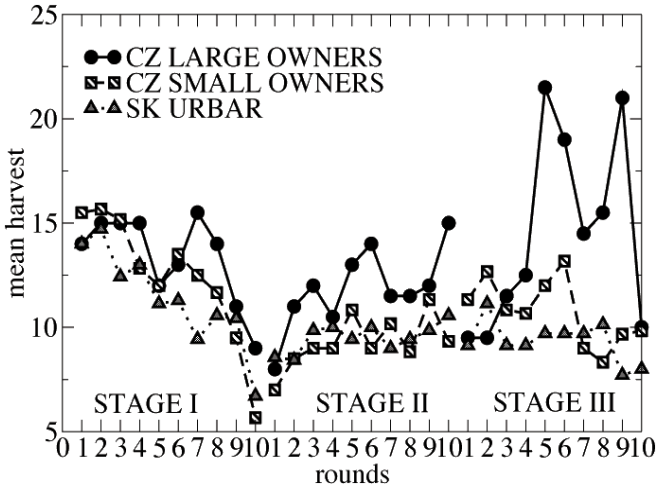
Group harvest data gathered during the games was compared to reveal differences in behaviour among particular groups and stages of the game. Specifically we compared urbar groups on one hand and groups of individuals on the other. Further, from the basic observation and interviews it was apparent that groups containing large individual forest owners (INDIV 3 and 4) showed different patterns of behaviour than those including only small individual forest owners.[2] Therefore, results of both group types are reported separately.

[2] We have considered large forest owners starting from the ownership of at least 10 ha. Small individual forest owners usually did not own more than 3 ha of forest.

4. Discussion and Results

Figure 1 shows the dynamics of group harvesting in the each round in all three stages. The technical group harvest maximum was 25 trees per round. The sustainable level of harvesting was 10 trees per round (so 9 of 10 trees could have been re-grown after each round).

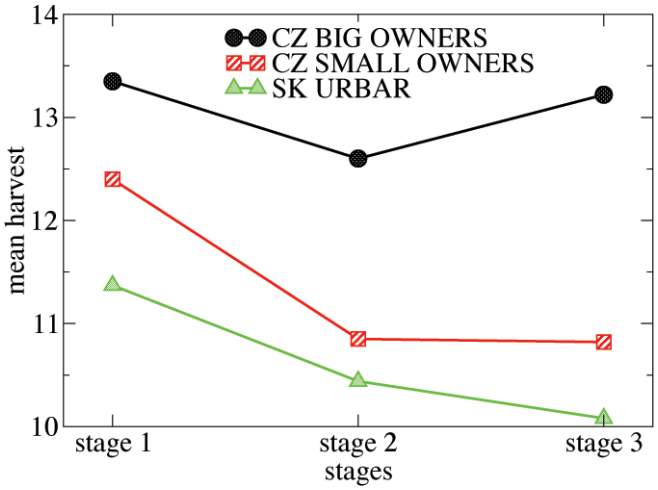
Figure 1, Mean group harvest (in trees) per round



Source: authors

Figure 2 shows pre-calculated average harvesting in the each group in all three stages. Urbars (SK1-SK7) harvesting was much lower in each stage compared to czechs individual small and large owners. At the first stage, the mean harvest over all urbars groups (11.5) is approximately 20 % lower compared with the mean over large private forest owners (13.5). The mean value of over small-scale owners (12.5) is also lower compared with large owners, while it is higher compared with urbars. Having introduced additional rules into the second stage, the mean value over all urbars decreased to the value 10.5. The private forest owners have also shown lower mean values compared with the open access stage. In self-government stage, harvesting decreased in the mean value over all urbars to the value 10. Private owners experienced increase change.

Figure 2:Mean harvesting per stages (mean harvest) comparison to urbars and individual (private owners).



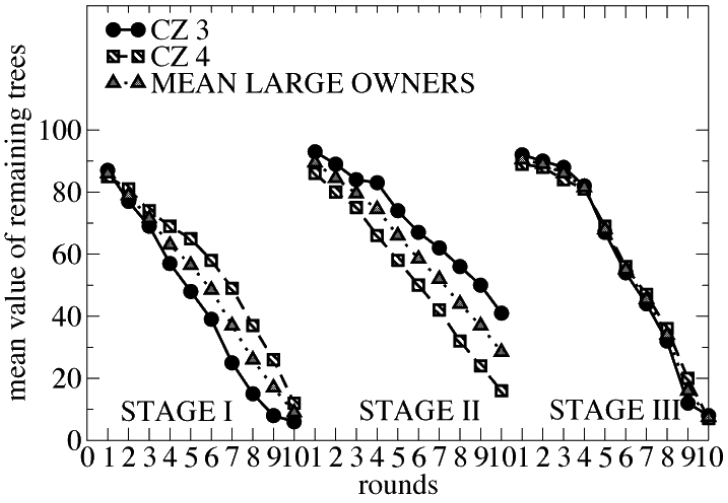
Source: authors

Figure 3 shows detailed forest stock depletion in all three stages in the case of large-scale owners. Within groups of large owners, cheating was a frequent behaviour, which again resulted in the forest depletion at the end of each stage, as shown in Figure 3. The explanation for this phenomenon provided in interviews was stronger motivation for maximizing profit in the case of large owners.

Figure 4 and 5 shows pre-calculated the mean values of forest remaining trees in each round for small-scale owner groups and urbars within each stage. Harvesting strategy of urbars resulted in the highest forest remains in almost all three stages, as shown in Figure 5. In Stage I more than 80% of forest stock remains. It was 8 times higher compared with large-scale individual owners (Figure 3) and roughly 2 times higher compared with small-scale private owners as illustrated in Figure 4. When external rules were imposed in Stage II, the forest stock of urbars and small owners remained above 80%. In some cases, particularly for urbars denoted as SK 2, SK 6, the forest stock remained nearly at maximum of 100 m^3. The exception was the behaviour of urbar denoted as SK4 which in both harvesting and forest depletion followed large owners, as illustrated in Figure 5. The forest stock of small-scale owners in the Stage II and III increased roughly 3 times compared with the open access stage (Stage I). Forest stock of urbars remained above 40% in the self-governance stage (Stage III) The significant reduction in remaining trees mean values of urbars were caused by

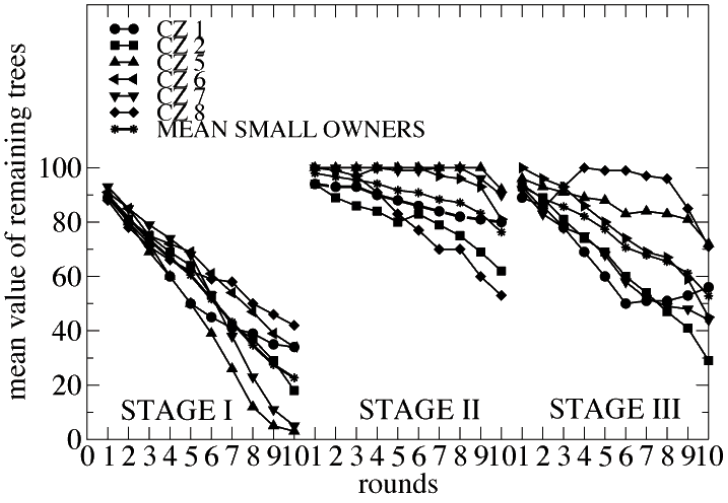
overharvesting by two urbars denoted as SK 4 and SK 6. If we exclude those urbars from the mean calculation the forest stock would be remained over 60%. The private owners groups exhibited large depletion of forest stock under 20%.

Figure 3, Mean value for remains of forest stock at the end of each round for two large owner groups.



Source: authors

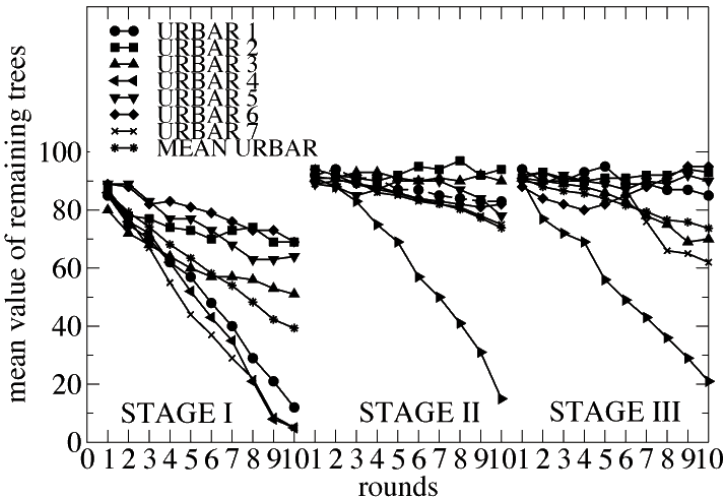
Figure 4, Mean value for remains of forest stock at the end of each round for 6 small owner groups.



Source: authors

Poorer results were observed during Stage I due to an open access situation within which only the technical limit existed and no communication among players was allowed. During Stage I, most groups overharvested at the beginning and later reduced the extraction as the forest disappeared, except for large-scale owners. Stage III shows the increasing variability in the harvesting of large owners, which was driven by the articulated group goal of maximizing profit. Large owners kept the harvest at a sustainable level, first four rounds, and than started to clear cut. Their harvesting strategy resulted in an unanimous group goal within Stage III. The equalization of personal incomes was the main feature seen within this stage.

Figure 5, Mean value for remains of forest stock at the end of each round for seven Slovak urbars.



Source: authors

Small-scale owners tried to compromise between sufficient extraction and forest sustainability. During Stage II, small-scale owners kept the agreed formal rule and they showed a large aversion to the risk stemming from official sanctions. In this stage, the majority of small owners kept the chosen formal rule allowing a total harvest of only 10 trees per round. There was a clear ambiguity in the decision-making of small-scale owners varying from sustainability (to keep the forest) to income generation (to earn some money). This compromise is clear from the result within Stage III. There were minimum differences between Stage II and III of the game, not even formal rules were agreed during Stage III. Cheating on an informal agreement did not appear. In contrast to large-scale owners, small

ones finished with half as many trees. They also showed a high respect for both, formal and informal rules.

Urbar groups showed a resource-sustainable oriented logic. Within Stage II and III, urbar groups had the greatest amount of forest remaining. During Stage II, the majority of urbar members kept the chosen formal rule allowing a total harvest of only 10 trees per round. Urbar groups intended to keep the harvest close to forest re-growth. This is apparent from Stage II (no cheating on the formal rules) and Stage III (establishing informal rules respecting ecosystem dynamics).

Generally, the communication within Stage III had a positive effect on developing a shared understanding and common group strategy. Urbars saw a longer time-horizon than the official ten rounds of the game, and thus their primary objective was to keep enough trees to ensure continuity of resource use. As a result, some players did not free ride at the expense of others. However, in the case of individual forest owners, this coordination of interest resulted in less sustainable behaviour than in Stage II where no communication was allowed. This finding does not support other studies accenting the effect of communication (such as Janssen et al., 2010 or Ostrom, 1998).

Further, informal rules played an important role within groups, as they do in reality, where individuals know each other, live in the same territory and cope with similar problems over resource use. The strong respect for informal rules appeared in all group types and resulted in meeting agreed harvesting strategies.

5. Conclusion

Social dilemmas over CPRs and optimal property regimes to solve them are challenging research issues. Within our paper, we used a field experiment to test the sustainability of forest owners' behaviour under an individual and common property regime in two post-socialist countries (the Czech and Slovak republics) sharing a majority of historical, socio-economic and resource-regime aspects. Sustainability was defined as the harvest that equals forest renewal over time. Together, 15 groups attended the experiment, of which 7

represented the common property regime (so-called urbars) and 8 the individual property regime.

Our results support broader research findings based on numerous empirical observations of long lasting common property regimes all over the world (Poteete et al., 2010; Quinn et al., 2007; Ostrom, 2006). In this context, Slovakian forest urbars can be considered as an historically grounded institution in which 40 years of forest nationalisation did not bring large changes in the views of current forest owners (see also Kluvánková-Oravská, fothcoming). Further, the results from Stages I and II confirmed the previous findings of Cardenas et al. (forthcoming) regarding the CPRs depletion under the open access regime.

The hypothesis assuming higher sustainability of forest owners under common property regimes was confirmed, although the extent of the experiment did not bring a robust conclusion. Also, substantial differences in the behaviour of small-scale and large-scale individual forest owners were revealed. Further, we identified the importance of communication for the development of shared group harvest strategies. The ability to adopt informal rules and to voluntarily follow them appeared to be an important feature of resource management at the local level.

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