Discussing the role of Japanese forestry subsidies for the implementation of environmental impact assessment - The case of Kochi Prefecture

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Abstract

The Japanese government subsidizes private forests to maintain and enhance the multifunctional role of forests as a provider of wood and non-wood resources and as a natural habitat for humanity and other life forms. However, subsidies for forestry practices have been criticized by researchers in various countries for rarely achieving planned outcomes, for being non-beneficial to society, and for threatening the natural balance of the environment. Threats to natural balance such as degrading coniferous plantations, decreasing biotic diversity, and declining quality of freshwater have been observed in Japan, suggesting that current forestry subsidies may not be capable of achieving the sustainability objectives of the Japanese national government. Previous research on the sustainability of forestry subsidies in Japan has addressed the economic efficiency of Japanese forest subsidy schemes. Yet, to fully address the characteristics of sustainable forest management (SFM) the potential environmental impacts of forest subsidies on private forests must also be considered. Without decentralized forest subsidy objectives that directly address local-level unique economic and environmental forest characteristics, and without active forest owner management involvement, private forests in Kami City, and likely other regions in Japan, will remain ecologically fragile. Environmental impact assessment as part of determining subsidies for forest operations may have the potential to make regional forest resource management sustainable.

Key words: forestry subsidies, sustainable forest management, forest resource management, policy decentralization, Japan

1. Introduction

The Japanese government subsidizes private forests to maintain and enhance the multifunctional role of forests as a provider of wood and non-wood resources and as a natural habitat for humanity and other life forms. Almost every country in the world subsidizes the management of its forests, mainly to restore the landscape, to increase environmental benefits, and to develop the forestry and wood industry. While forests for landscape restoration and forests for the preservation of the environment are typically mixed forest cultures, forests for industrial development commonly consist of coniferous forest plantations. Subsidizing forest practices has led to an increase in the forest area in various industrialized nations worldwide [(1)]. However, the increase in the type of forest land has been uneven, and the area of forest plantations has grown. According to The Food and Agriculture Organization of the United Nations (FAO) [(2)], forest plantations are likely to exceed an area of about 300 million hectares worldwide within the near future. In the world, an average of 75% of the cost of managing plantations is subsidized by governments. This high financial support for forest plantations is usually justified by governments with the difficulty of maintaining a crucial balance between economic

viability and environmental preservation [3;4]. However, although forestry subsidies are justified by governments for being a beneficial implementation tool for improving the management of forests, subsidies that promote industrial plantations and that offer direct funding to logging companies are nowadays increasingly considered harmful, and are criticized worldwide [5;6].

Apart from the financial burden on society that these subsidies create, researchers from various countries have argued about the contribution of forest subsidies to achieving sustainability goals, revealing the possibility of forestry subsidies bringing negative, if not devastating side effects to the environment [3;4;7;8;9;10]. For instance, subsidies for the management of industrial plantations can bring adverse effects to man-made capital, such as subsidies that fail to fulfill employment promises, or that lead to low-quality timber due to degradation. Also, these subsidies can bring adverse effects to natural capital by indirectly promoting a decrease in biodiversity, which leads to ineffective plantation management [11]. Such harmful subsidies are inhospitable for the sustainable development of society [12;13]. To stimulate the development of a sustainable society, harmful subsidies are suggested to be eliminated to avoid further destruction of man-made and natural capital [1;9]. To eliminate harmful forestry subsidies, action plans are currently implemented by governments in various industrialized nations, both nationally and locally [7;14].

As stated by the Japan Ministry of Agriculture, Forestry and Fisheries (MAFF), subsidizing forest management in Japan is a strategy that follows two main objectives: (1) to increase man-made capital by improving the profitability of the domestic forestry industry against imported low-cost primary timber products, and (2) to enhance natural capital by maintaining and improving the multifunctional role of forests as a provider of forest resources, and as a natural habitat for the human being and other wildlife creatures. Of these two objectives, the latter has so far gained a higher attention. To increase the production of natural capital for the future wellbeing of society, the Japan Ministry of the Environment (MOE) has adopted the new National Biodiversity Strategy of Japan (NBSJ) 2012-2020. According to the NBSJ, natural capital is to be enhanced by promoting the establishment of forests that maintain or improve their multiple functionalities by creating “a good balance of forests”. To achieve a good balance of forests, the government of Japan implements extensive measures, policies, and management strategies. One of these management strategies is the promotion of forests that consist of a variety of tree species (hereinafter referred to as mixed cultures). [15] Such a mixed culture strategy has considerable potential to increase natural capital by improving the vitality of forest and forest robustness, while simultaneously mitigating the environmental effects of climate change [16;17;18].

Approximately 60% of Japanese forests are owned privately and their management is directly and indirectly subsidized by the Japanese government [19;20]. Most private forest owners in Japan that qualify for financial support for managing their forest hold less than or equal to one hectare of forest land each [21]. Due to this large number of private forest owners that hold a comparatively small area of forestland in Japan, effective management that incorporates all forest owners and that equally addresses private and social needs and wants has been a great challenge for Japanese forest managers. It can therefore be expected that subsidy schemes for private forests include proper implementation incentives that embody MOE objectives. However, as previous researchers have observed, forestry subsidy schemes seem to commonly fail to fulfill economic and environmental objectives [22]. Japanese forestry subsidies are no exception. Notably, large areas of plantations, e. g. Japanese red pine (*Pinus densiflora*) in Kochi Prefecture, have shown signs of degradation. Also, contamination of the Monobe River with eroded forest soil has led to a worrying decline of the ayu sweetfish (*Plecoglossus altivelis*) population. Despite being a primary objective of the MOE, no coniferous monocultures have been or are being converted to mixed cultures at this moment. These unfortunate

unsustainable developments raise the question of whether current financial support schemes for private forest management are clearly formulated and implemented well enough to reach the sustainability goals of the MOE [23;24].

This study has two purposes. (1) It discusses the objectives and means of management of currently available forestry subsidies for the private forest in the study site Kami City, Kochi Prefecture, Japan, and (2) highlights implementation issues of forest management that are relevant for introducing environmental impact assessment as a part of subsidy schemes for the enhancement of man-made and natural capital of Japanese forests.

2. Materials and methods

2.1. Study site

Kami City is located in Kochi Prefecture in the southern region of Shikoku Island, Japan (Fig.1). Kami City is well known by forest managers throughout Japan for Kami Forest Owners' Association, Japan's first forest owners' association that was publicly financed a cable yarder as part of a government thinning promotion program in 2011[1]. Besides Kami City's access to state-of-the-art forest machinery, it was selected as a study site due to its exceptionally high distribution of private forests. Nearly 91% of the 19,516 ha of forest land in Kami City are held by private forest owners. Of this 91%, approximately 75% are industrial plantations, which almost completely consist of sugi (*Cryptomeria japonica*) and hinoki (*Chamaecyparis obtusa*) monocultures. Most of these monocultures have reached maturity with age structures between 50 and 60 years. The timber in these stands is ready to be marketed. However, despite marketability, roundwood prices have been declining significantly over the past decades and have now fallen to near or below harvesting costs, respectively. Especially affected by this sharp cost decline are sugi stands, making them dependent on financial support for management activities that involve the removal of timber. Close to 100% of private forest in Kami City is receiving direct financial support for forest management activities.

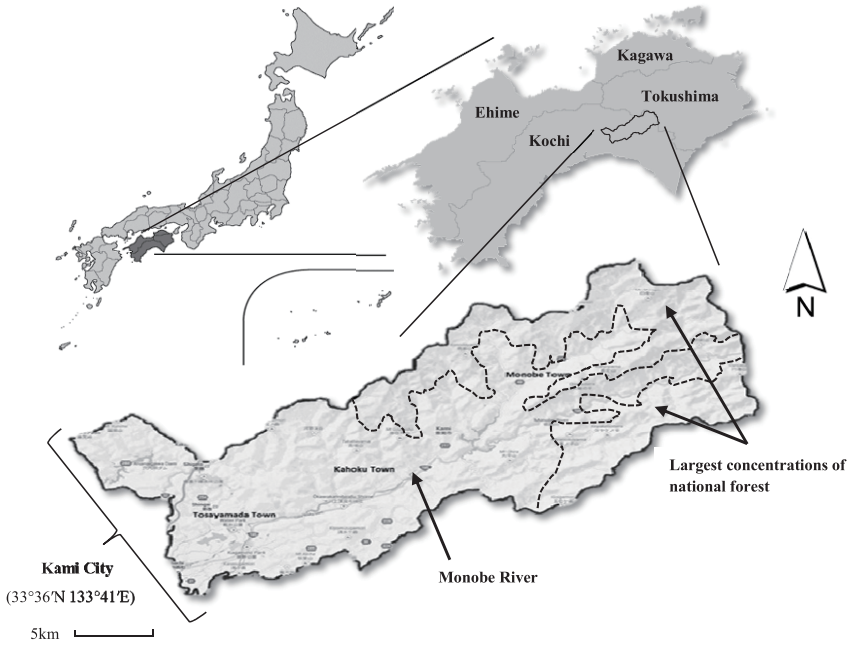

Fig. 1: Location of study site

2.2. Material collection and preparation

Official objective statements and descriptions of currently available forestry subsidies for private forests have been acquired from Kochi Prefecture Office. Apart from the data collected from Kochi Prefecture Office, the same set of data was available and collected for verification purposes from Kami Forest Owners' Association. There, it is used for negotiation purposes with private forest owners to discuss the applicability of financial support for forest management interventions in their forests. According to the collected data, a total of ten different types of subsidies are currently available to financially support private forest management.

Apart from the administrative framework of the current forestry subsidy scheme selected for this study, monetary data for the past five fiscal years from Kami Forest Owners' Association was acquired, to provide an annual breakdown of the financial distribution of each subsidy.

2.2.1. Preparation of contrasting subsidy scheme to NBSJ objectives

The financial distribution of subsidies is divided by more than one public authority.[1] Two subsidies are exclusively provided in cooperation with the national and the prefectural government, while the remaining subsidies receive additional support from the municipality government. The arranged subsidy data was then ready to be contrasted to the objectives of the NBSJ. However, the NBSJ forestry objectives are very diverse and include for example objectives of non-silvicultural nature, or objectives that address certain aspects of forest management and not forest management in general, which are not affected by the effects of the subsidy scheme and which are irrelevant for this study. Focus was given on the NBSJ objectives that directly target silvicultural action in forest management in general and that are to be applied to private forest in Japan, and not only in selected areas. These objectives are (1) Development of diverse forests, (2) Forest conservation and management, and (3) Control of wildlife damage to forests. Following, expected direct and indirect influence of each subsidy on selected NBSJ objectives 1-3 was assessed based on the characteristics of each given subsidy. Direct influence was demonstrated if management effects of a subsidy were to be expected to go in concordance with the respective official NBSJ objective statements. Indirect influence was demonstrated if management effects of a subsidy that were to be expected were likely to produce additional or different effects than those stated in the respective official NBSJ objective statement.

2.2.2. Limitations

It is important to note that monetary data was not available for every single subsidy and was only available in a summarized manner. In addition, data on the spatial distribution of subsidies was also not available at the time of data collection, which would have provided an even more accurate picture of applied forest management with and without the use of subsidies. Nevertheless, the available data should provide ample detail for the analysis, which should be capable of showing in which way subsidies have been used for local forest management interventions in the research area. Subsidies addressing the development of industrial infrastructures, such as funds for forest road construction, machinery or workforce were not part of this study as they do not directly influence forest ecology. All data and information collected were solely available in the Japanese language at the time of data collection.

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[1] Private forest owners are encouraged to apply for financial support at the municipal government office. However, direct application is rather uncommon and is in most cases taken over by the forest owners' association in charge, mainly due to lack of silvicultural and managerial expertise of private forest owners.

3. Results

As mentioned in the Introduction, since degrading forests are present, and no industrial plantations are being converted to mixed cultures in the research site Kami City, it was reasoned that an examination and evaluation of current local Japanese subsidy schemes and their implementation procedures would be urgently necessary to assess their strategic potential towards achieving the goals of the MOE and generally speaking SFM. It is known from the literature that forestry subsidies are often criticized for not being able to sufficiently put national objectives into practice on a local level while being conservative and not systematically promoting sustainable development of the forestry sector. As for the results, they are in overall concordance with previous concern that the currently available subsidy scheme in Kami City may not provide the framework for accomplishing national forestry objectives.

3.1. Preference towards national forest planning system

More than 90% of subsidies are awarded to forests under national planning systems and whose management is carried out by the local forest owners' association. Only a comparatively small segment of private forest owners decides to self-manage their stands without administrative help. This significant difference indicates that instead of self-managing, about nine in ten private forest owners seem to prefer management to be taken over by government-assigned local forest institutions by agreeing to become part of the national forest planning system. Reasons for this clear preference may lie in the large difference in the degree of necessary personal input and overall complexity of implementing sustainable forest management. While in self-administered forest management all management is carried out or arranged by the forest owner, the forest planning system is an "all-inclusive package", which only requires a signature from the forest owner for the transfer of administration rights. Personal creative input from the forest owner in regard to forest management is no longer needed. Lack of management expertise of private forest owners and trust in the government to carry out management in their interest is likely to additionally support a decision towards the forest planning system.

3.3. Sustainable balance

As for the subsidies themselves, a balance of economic, environmental, and social incentives was expected. However, it appears that the primary target of the subsidy schemes is the conservation and the improvement of the management of existing stands, and they appear to be considerably biased towards the enhancement of man-made capital while neglecting natural goals. All five subsidies that are available to private forest owners with stands under a certain public planning system provide financial support for selective cutting of stands of various age structures. Management measures target three major intervention strategies that are the removal of low quality, unmarketable and infectious timber based on stand age and median diameter at breast height (DBH)[2]. Two subsidies are mainly financial support for the removal of marketable timber. While two subsidies target proper forest development, specific natural or social goals are not mentioned, raising the concern that these subsidies may promote the development of monocultures for improving economic efficiency. Two subsidies for self-administered forest management provide a similar picture, which even

[2] DBH is the most frequent dendrometric measurement to determine tree diameter, volume, growth or overall forest growth potential. Measurement is normally taken using calipers or diameter tape at outside bark at about 1.3m above ground of the uphill side of the tree.

explicitly specify the enhancement of economic development through the removal of “unmarketable timber”.

3.4. Conversion to mixed cultures

Four of the ten analyzed subsidies appear to directly address an enhancement of natural capital. One subsidy exclusively targets conservation of protective forests through the removal of infectious and improperly developing trees. These are crucial forest care measures in order to maintain or enhance forest vitality to ensure maximum economic and environmental benefit. Two subsidies are carried out in combination and target reforestation and the prevention of wildlife damage. However, based on NBSJ objective 1 “Development of diverse forests”, it was expected that these subsidies clearly define and support the transition to multi-storied mixed cultures. It appears that reforestation is generally addressed without differentiating between monocultures and mixed cultures, which would indicate that reforestation to monocultures is also possible. Management interventions include the removal of infectious and low-quality timber. In addition, if a large environmental benefit can be expected, financial support by national and prefectural government offices may be granted to up to 72%, the largest coverage among all available subsidies, not including the additional financial support from municipality.

3.5. Restriction to forest stand age

Financial support appears to be limited based on stand age. Most subsidies have limited applicability with stand ages of a maximum of 60 years, which is coincidently also the time when sugi and hinoki stands reach maturity and become ready for commercial felling. As apparent in Table 1, Subsidy no. 4 (Renewal Thinning) can be applied to forests of ages of up to 90 years, however, which also can be subject to commercial felling. Stands older than 90 years do not seem to be financially promoted under the present subsidy scheme. Moreover, the number of subsidies annually awarded does not seem to be comparable year to year. Annual capital flow for forestry subsidies has fluctuated by up to 400 percent, indicating large dynamics in practical application. To ask for clarification for this irregularity, Kami City Forest Owners’ Association officials were consulted. It was stated that market demands for roundwood would affect forest management interventions, and with it, the application of subsidies to private forest. This statement suggests that the entire present subsidy scheme may be to some degree driven by local roundwood markets.

Table 1

Type of subsidy	Stand age (years)	Type of management	Area (ha)	Intensity	Support requirements	Subsidy rate (N,P)[a]	Subsidy rate (M)[b]
Renewal thinning	~90	negative selection and commercial thinning	0.1+ (5+)[c]	30%	Stands approved for forest management scheme. Stands approved for silviculture scheme but target for enforcement plan. Stands under thinning promotion plan based on the Special Measures Law but target for enforcement plan.	68%	1,000 Yen/m^3

[a] N: National government; P: Prefectural government

[b] M: Municipality government

[c] Stands under forest management implementation plan in the business of a particular thinning promotion plan based on the Special Measures Law.

4. Discussion

Revisiting the Introduction to restate the aims of this paper, the original hypothesis that local Japanese forestry subsidies could be an ineffective implementation strategy of national sustainable forestry goals could be true. Previous work introduced in this study earlier has suggested that forestry subsidies do in the rarest cases fully address the key ideas of sustainable development, which are to create forests that equally fulfill economic, environmental, and social needs. However, these studies have either addressed forestry subsidies on a macro-level or have addressed only certain aspects of sustainable forestry rather than the whole. As sustainable forest management measures are implemented in practice at the local level, it was considered necessary to evaluate forestry subsidies on a micro-level to reveal their full potential. In this study, the performance of the current forestry subsidy scheme of ten forestry subsidies for private forest in Kami City/Kochi Prefecture was analyzed, by contrasting them to a selection of general forestry objectives of the new National Biodiversity Strategy of Japan (NBSJ). Findings suggest what was anticipated earlier: the subsidy scheme analyzed in this work does not seem to fully address all three key forest management objectives of the NBSJ.

4.1. Public funding for revitalization of monocultures

It can be argued with some reserved confidence that the selected forestry subsidy scheme could in its current form be a publicly financed revitalization project of private monocultures, with the expectation of governmental authorities to achieve environmental and economic goals. This theory is based on five important findings:

1. Eight in ten subsidies merely target thinning. Although thinning enhances forest vitality, it also increases productivity, which could be favored.
2. All but one of the subsidies that target thinning is only applicable to stand ages of a max. 60 years, which at the same time is the maturity age of the currently planted sugi and hinoki plantations.
3. Three subsidies explicitly incorporate economic development by commercial felling.
4. The reforestation subsidy does not restrict the selection of tree species, which would be necessary for the design of multicultural forests. A reestablishment of monocultures is also possible.
5. Private forests older than 60 or 90 years are not subject to financial support under the present subsidy scheme.

Approximately 70% of plantation costs are subsidized by the national and prefectural government, not including the extra financial support of the local government; a rate close to average in Asia.[3] At such a rate, and without alternative support options available, private forest owners are encouraged to expand or develop new areas of coniferous monocultures.

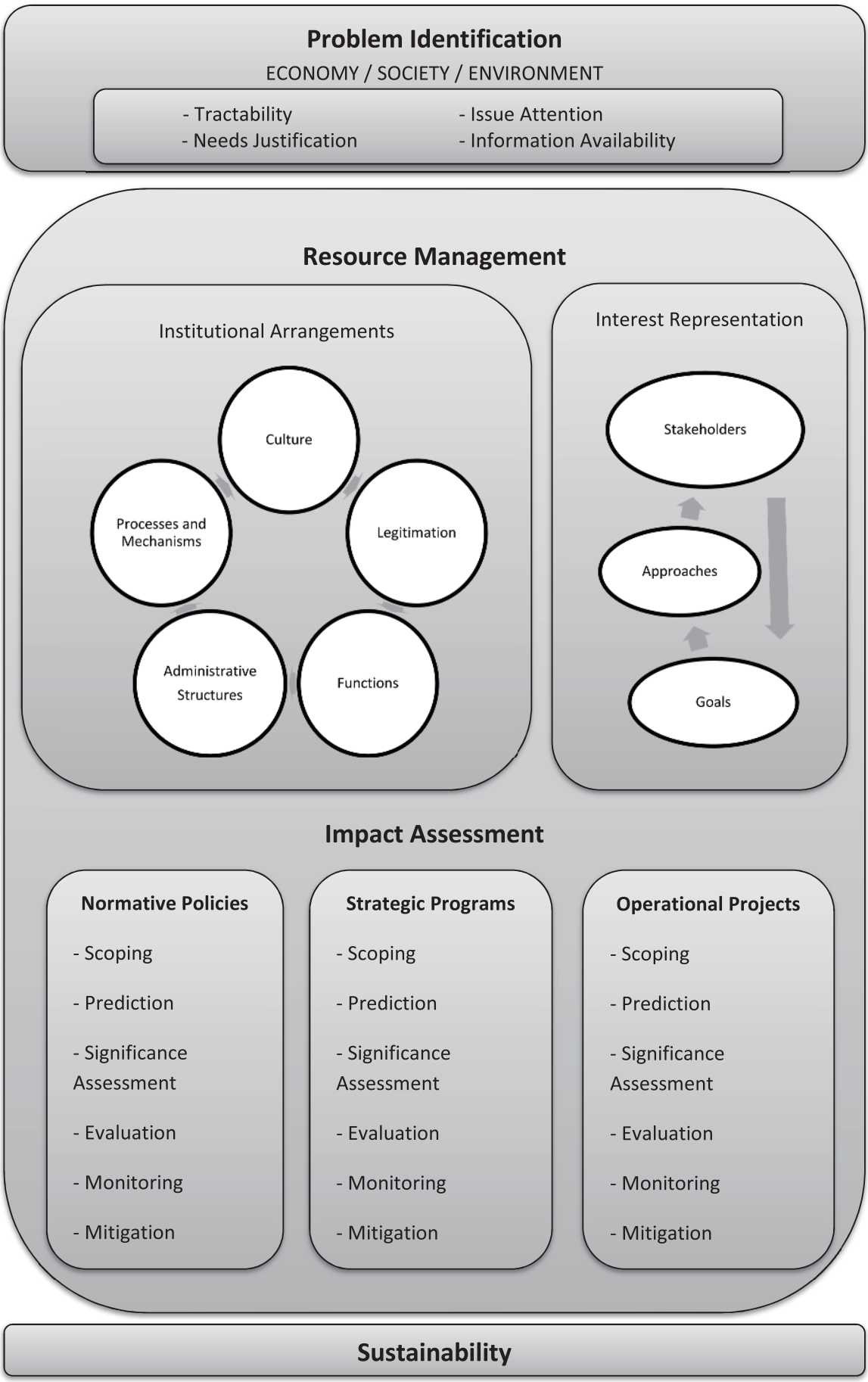

Fig. 2: An integrative framework for sustainable resource management (Graham Smith, 1993) [27]

4.2. Risks of promoting coniferous monocultures

Findings extend those of Nakajima, et al. (2010) [19], which have revealed a lack of efficiency of Japanese subsidy schemes to enhance the man-made capital of domestic forests. Evaluation of the results of the analyzed subsidy scheme in this study shows that it has the potential to maintain or enhance natural capital. Eight in ten subsidies target thinning, an important forest management care measure to maintain or enhance forest productivity as well as ecological vitality and resistance, even in coniferous monocultures. However, although monocultures, if viewed from a business management perspective, may be considered the ideal solution bringing most economic benefits to society, monocultures are coupled with powerful risks whose effects could influence generations in the near and far future [25]. For example, an oversupply of timber of merely one or two tree species could trigger market prices to drop. Monocultures sustain low wildlife diversity [26]. Monocultures deliver ideal habitats for various wildlife creatures and insects that use them as a source for nutriment. Populations normally develop rapidly under such homogeneous ecological conditions and outnumber natural predators creating damage and pests that could become difficult and costly to control and may involve the use of chemicals to combat. The use of chemicals and pesticides to regain control of infections and pests can affect human health by entering groundwater, or by eating the meat of contaminated domestic wildlife. Also, hinoki and sugi are shade tree species that in unitary cultivation block most of the sunlight to reach the forest floor when the canopy becomes dense, increasing the risk for soil erosion. Rainfall may transport eroded soil to nearby aquatic habitats affecting their environmental balance, as currently experienced in Monobe River.

4.3. Clear objectives

Objective statements not incorporating national forestry objectives of the NBSJ of the ten analyzed forestry subsidies were identified. For instance, none of the ten subsidies have the objective to create mixed forests that consist of various tree species including coniferous and deciduous species.

For forestry subsidy schemes to become effective local implementation tools for achieving national sustainability goals, a detailed description and implementation outline for each subsidy are inevitable. Lack of description detail of subsidy schemes runs two fundamental local implementation risks. (1) Unintentional misinterpretation by local forest managers during the implementation of these subsidies can lead to results that may be different from national objectives. For instance, such misinterpretation may already have occurred in the selection of tree species for reforestation at the study site. For a transformation of coniferous monocultures to mixed forest, detailed instruction for applicable deciduous species utilizable for each particular stand will eliminate the risk of forest managers to select identical or other coniferous species that create a less or lower environmental and economic benefit. The second risk is (2) deliberate negligence of the implementation of environmental objectives by forest managers to avoid the complication of management practices and an increase in management costs. For instance, compared to mixed cultures, the silvicultural organization of coniferous monocultures is less complicated, and their management is less cost intensive. These conditions of coniferous monocultures increase the likelihood of earlier and higher financial returns. Imprecise description of subsidy objectives increases the risk of forest managers to exploit “loopholes” which can enable counter-productive management processes.

The NBSJ forestry objectives were renewed in 2011. After this reform of national forestry objectives, the objectives of the forestry subsidy scheme in Kami City have not yet been adapted to those changes. Nevertheless, to implement the vision of the Japanese government to develop sustainable forestry, an adaptation of local subsidy scheme objectives to match those of the national government is needed and must

be executed promptly to prevent the possibility of environmental damage through misinterpretation and/or deliberate negligence of imprecise forest subsidy objectives.

4.4. Decentralization

For financial support systems to become capable of enhancing man-made and natural capital, policymakers and local managers are responsible for effectively weighing all potential risks before final management decisions are made [28]. A detailed formulation of policy to avoid misinterpretation at local implementation, as well as support systems specifically designed at the regional level to meet the unique characteristics of local forests will be vital in this approach. In comparison, the Bavarian subsidy scheme for the private and corporate forest of 2007 directly aims at the creation of vital and climate-resistant mixed cultures, while indicating in detail the exact tree species and their minimum planting density that is necessary to qualify for financial support, making pure monoculture management completely excluded from financial support[3]. However, the regional design of subsidy schemes and their implementation is very difficult in Japan. As indicated in an earlier study, Japan's legal framework does not allow the passing of legally binding prefecture-level forest laws, and national forest policy addresses SFM in a relatively broad sense [29]. Also, unlike other industrialized nations, Japan does not have a forester system that would be capable of acting as a source for professional silvicultural expertise or to act as a mediator to negotiate the demands of local stakeholders. Healthy forests are of public interest, however, and with the internationally rising demand for forests, management has become uncertain [30]. SFM delivers the framework for sustainable development, but it is not a concept to eliminate uncertainty [31;32;33]. Risks remain a serious problem in decision-making processes, and centralized policy (as found in Japan) is an inadequate measure to address them [34]. Because of the unique characteristics of each forest and their surrounding habitats, the decentralization of forest subsidy schemes that address proper management for every unique condition seems to be a logical step towards successful implementation.

4.5. Forest owner participation

Yamaba and Nakagoshi (2000) [35] observed that large dynamics in Japanese domestic wood markets and policy development would make extended multi-stakeholder participation inevitable. The authors point out a serious recent problem in Japan; the increasing loss of interest of private forest owners in active involvement in forest management. Even higher subsidies do not seem to be enough of an incentive for active participation anymore [36;37]. Therefore, introducing financial incentives for public forest management projects, as frequently executed by the Japanese forest planning system, bring about the elemental risk of merely "purchasing" forest owner participation [38]. Also, transferring the authority to make management decisions by the forest planning system may further decrease the engagement of private forest owners in management-related decisions. These types of one-time agreements are not designed for a long-term relationship, and interest shown by forest owners is in most cases simply for the present moment. Forest management requires active long-term participation of private forest owners to strengthen general public involvement and to avoid a further disinterest in environmental issues. The reason for lack of active long-term participation is in the least cases lack of capital, but instead a lack of available information on available market chances, access to silvicultural technology, forest law development, and taxation support. Investments that would have been made by private forest owners themselves with proper advice and guidance are lost with one-time

[3] The Bavarian financial support scheme for forest management measures in private and corporate forest was discontinued in the end of 2013 but was updated and reestablished in August 2014.

management agreements [4]. Therefore, policies regarding management limitations and subsidies should involve the communication of local stakeholders to determine the appropriacy of response decisions [39]. The homogeneity of tree plantations and their potential negative effects on the production of natural and even man-made capital must be reevaluated, and proper mediation between private and non-private stakeholders will play an important role in this process [40;41].

4.6. Problem identification for environmental impact assessment

As can be seen in Figure 1, Graham Smith (1993) [27] defines environmental impact assessment as an integral part of environmental planning and resource management, with the goal of achieving sustainability. The effort to make environmental impact assessment a part of financial support systems for private forest in Japan may face several challenges. The role of stakeholders should be clearly defined and seen as equal. Problems regarding the execution of environmental impact assessment as a process from start to finish of forest resource management should be understood and agreed upon by all stakeholders. Such problems may arise in the economy, society, or the environment and must be identified. The better problems are understood, the more tractable they become. Tractability of problems influences the identification of problems greatly for both organizations (e.g. Forest Owners' Associations, prefecture and municipal government, NGO) and individuals (private forest owners). The justification of needs during decision-making processes regarding the application of subsidies for forest management must not restrict the range of problems. Attention must be generated and widely communicated among organizations and individuals. Especially the public takes a vital role here. The more the public is aware of problems the more actively it will act as a stakeholder and define needs. Lastly, information on problems must be widely available and describe how these problems influence forest resource management. Such information should go beyond economic aspects and fully include society and the environment. In the case of Kochi Prefecture, the latter information may have to be generated and included to current economic information. For environmental impact assessment to become an effective part of forest resource management, problem identification must be tractable, justify needs, pay attention to issues, and information must be widely available. Awareness of such problems could be managed by local expert risk mediation [42].

5. Conclusion

It appears that the present subsidy scheme has not yet been adjusted to the forestry aims of the NBSJ to promote equal enhancement of natural and man-made capital in the desired way. To achieve the first fundamental goal of the NBSJ, which is the proposal of forest operation methods to forest owners for the promotion of multi-storied forests made up of various tree species, the forest subsidy scheme of Kami City, and likely those in other domestic areas in Japan, need careful adjustment in especially three areas: (1) Local adjustment of subsidy scheme through decentralization and local multi-stakeholder consensus building. Local forest conditions are too diverse to be effectively addressed by national policy. Active involvement by forest owners and implementation of a silvicultural knowledge party that acts as a mediator and advisor for personal investment through market opportunities, as well as applicable financial support for management interventions that are in the interest of the general public, to facilitate effective decision-making processes and to lower environmental uncertainty are necessary. Subsidies with the aim of environmental development must not be restricted to forest age to avoid the probability of clear-cutting. (2) A clear and detailed description of how to

convert sugi and hinoki monocultures to multi-storied mixed cultures based on local forest characteristics. Subsidies must include detailed performance directives such as density, tree species distribution, forest vitality, and optimal growth and development. Reforestation and afforestation subsidies must be designed to avoid the possibility of misapplication that could lead to a publicly financed creation, recreation, or even expansion of monocultures. (3) Active public involvement to improve human resources. A subsidy scheme that enables private forest owners to transfer authority of management is not a sustainable management strategy as it further distances the public from active involvement in environmental management. Forest owners must be involved in decision-making processes to maintain a dynamic and diverse management network [43]. Such a management network creates synergy effects among private forest owners which have the potential to spread knowledge and expertise, and which have an educational effect on individuals not directly involved in environmental management issues.

5.1. Closing remarks and future research

Results provide important arguments that sustainable forestry may not be accomplished under the current financial support system in the selected study site, and suggest that the national goals of the MOE and the NBSJ may not be able to be effectively implemented under this strategy. However, it should be noted that with all claims being made, an even clearer picture of this analysis could have been provided if additional information, such as regional application of subsidies, and more detailed information on the distribution of each particular subsidy, had been available at the time of data collection. The author supports the critique of Carle, et al. (2003) [44] that the quality of available forest plantation data worldwide must be improved to enable quality assessment. It is important to point out that long-term socio-economic and environmental effects of subsidies of any kind are hard to predict. The exact ways in which damage could be produced by subsidies are highly controversial and difficult to prove, as pointed out in several previous research publications. Future research is highly encouraged and should include follow-up work on the complexity in designing and implementing forest support systems at the local level in Japan, and that are an effective response to local environmental management issues, addressing equal enhancement of man-made and natural capital.

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