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Intergenerational retrospective viewpoints and individual preferences of policies for future: A deliberative experiment for forest management

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Abstract

Brain scientists establish that projecting future events can influence how human brains function and possibly current decisions (Schultz et al., 1997, Gilbert and Wilson, 2007, Gerlach et al., 2014, Szpunara et al., 2014). We design and institute a deliberative experiment to test whether acquisition and experience of intergenerational retrospective viewpoints as one way of projecting future events affect individual preferences for policies. To this end, we employ a case-method approach for forest management policies in Kochi prefecture, Japan, because the problems extend over multiple generations in nature. We prepare two treatments of non-retrospective and retrospective settings where subjects are asked to read through a case of forest management and to reveal preferences for policies at individual and group levels through deliberative discussions. Subjects in the retrospective treatment go through a series of procedures to acquire intergenerational retrospective viewpoints, while those in the non-retrospective treatment do not. The results reveal that acquisition and experience of intergenerational retrospective viewpoints affect individual preferences for forest policies in the sense that the most favorite policies chosen by subjects in the retrospective treatment are different from those in the non-retrospective treatment. Subjects in the retrospective treatment have tendencies to choose the policies as the most favorite that fundamentally change status-quo, while those in the non-retrospective treatment are opposite. Overall, this result suggests that some education or training for acquiring intergenerational retrospective viewpoints as part of projecting future could possibly affect the ways of thinking and preferences for possible betterment of the future.

Key Words: Intergenerational retrospective viewpoint; preferences of policies;

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1 Introduction

Intergenerational sustainability is pivotal for survival of human societies. However, it has been claimed that intergenerational sustainability is compromised as societies are developed and modernized under capitalism and democracy, as demonstrated by emergence of many environmental and natural resource problems such as climate change (Milinski et al., 2006, Schwartz, 2007, Maxwell et al., 2016, Shahrier et al., 2016, 2017). This is due to the fact that, under capitalism and democracy, the current generation tends to choose actions or policies that are to their benefits without considering future generations' needs, incurring an irreversible cost for future generations, which we call an "intergenerational sustainability dilemma." Social and brain scientists claim that introduction of some device, institutions, or mechanisms to imagine about future events may influence how human thinks, possibly affecting current decisions or strategies (See, e.g., Szpunara et al., 2014, Corcoran et al., 2017, Gonzalez-Ricoy and Gosseries, 2017). This paper addresses whether and how projecting future events can influence

individual ways of thinking and preferences for policies.

There have been several approaches to induce people to think about future. Among them, two approaches of backcasting and scenario planning attract much attention and have been applied for businesses and public policies. Backcasting is the approach with which a desirable future is specified, and how to reach a desirable future from a current generation's standpoint is considered by working backwards (see, e.g., Robinson, 1990). Scenario planning is the approach with which several scenarios about how the future might be and how the future events might affect an issue of interest over time are discussed and predicted, and then possible decisions are evaluated and updated based on the scenarios (see, e.g., Schoemaker, 1995, van Notten et al., 2003). A boundary of these two approaches seems not to be clear because a combination of these two approaches is frequently utilized together in applications (see, e.g., Kok et al., 2011).

Psychologists and economists study how specific intervention and experiences can affect people's intentions, preferences and subsequent behaviors (Webb and Sheeram, 2006, Voors et al., 2012, Callen et al., 2014, Kim and Lee, 2014, Prediger et al., 2014, Norton, 2017, Sheeran et al., 2017). It is also reported that people's preferences and behaviors can be affected by simple events or whims of circumstances, especially when people face unfamiliar situations (See, e.g., List, 2002, Webb and Sheeram, 2006). Brain scientists establish that projecting future events can influence how human brains function and possibly current decisions (Schultz et al., 1997, Gilbert and Wilson, 2007, Gerlach et al., 2014, Szpunara et al., 2014). A number of previous works apply backcasting and scenario planning to environmental problems and sustainability issues involving stakeholders, reporting that these two approaches are effective to generate a variety of scenarios and ideas for the future and sustainability as well as possible strategies that should be taken over time (Street, 1997, Peterson et al., 2003, Kok et al., 2011, Neuvonen et al., 2014). However, none of the previous researches experimentally and empirically examine how projecting future events influence the ways of thinking and preferences for environmental policies and natural resource management.

Given this state of affairs, we design and institute a deliberative experiment to test whether acquisition and experience of intergenerational retrospective viewpoints as one way of projecting future events affect individual preferences for policies. To this end, we employ a case-method approach for

forest management policies in Kochi prefecture, Japan, because the problems extend over multiple generations in nature. We prepare two treatments of non-retrospective and retrospective settings where subjects are asked to read through a case of forest management and to reveal preferences for policies at individual and group levels through deliberative discussions. Subjects in the retrospective treatment go through a series of procedures to acquire intergenerational retrospective viewpoints, while those in the non-retrospective treatment do not. The results reveal that acquisition and experience of intergenerational retrospective viewpoints affect individual preferences for forest policies in the sense that the most favorite policies chosen by subjects in the retrospective treatment are different from those in the non-retrospective treatment. Subjects in the retrospective treatment have tendencies to choose the policies as the most favorite that fundamentally change status-quo for the betterment of future, while those in the non-retrospective treatment are opposite. Overall, this result suggests that some education or training for acquiring intergenerational retrospective viewpoints as part of projecting future could possibly affect the ways of thinking and preferences for the future policies.

2 Methods and materials

The experiments have been implemented in Kochi University of Technology by inviting local residents as subjects. Kochi is a prefecture in Japan facing various forest management problems and how to utilize forest resources has been an important policy agenda over generations. Kochi can be considered a typical Japanese prefecture which is located far from big cities in Japan such as Osaka, Kyoto and Tokyo, and have been struggling with various social problems other than forest management problems such as population decline and low regional economic growth. We have prepared the two treatments in this experiment: non-retrospective and retrospective treatments to see how acquisition or experience of intergenerational retrospective viewpoints can affect the preferences of policies for forest management in Kochi prefecture.

For deliberative field experiments, we employ and develop a case-method approach to provide local residents with sufficient scientific information and facts for the policy agenda of forest management in Kochi prefecture within 30 minutes, following Barnes et al. (1994), Wassermann (1994), Andersen

and Schiano (2014). The case consists of a story which describes the forest management problems that have occurred over the last 100 years in Kochi and can be readily read and understood by typical Japanese adults (section 5.1). In the non-retrospective treatment, each subject is first asked to read and understand the case. Second, subjects are asked to choose the orders of preferences for the policy options of forest management in Kochi prefecture as an "initial choice." We have prepared the five policy options Kochi prefecture and people may follow if they wish (See section 5.1.3 for the detailed descriptions of five policy options). Each policy option is designed to have its pros and cons in the way that each option can be justified from one aspect and cannot be justified from the other aspect. After each subject fills the order of preferences for the policy options, we randomly match subjects to form a group of four people for group discussions. We ask each group to discuss and exchange ideas about what to do with forest management in Kochi prefecture for approximately 30 minutes. After that, each group is asked to determine the order of group preferences for the policy options without relying on majority voting. After the group discussions and the revelation of the group preferences, each subject finally fills the order of preferences among the policy options to see whether individual preferences change before and after the group discussions as a "final choice."

In the retrospective treatment, we have added another procedure for each subject to acquire or experience an intergenerational retrospective viewpoint, before subjects start reading the case. We distribute an article of newspapers published in 30 years ago regarding the Japanese government's research and development policies for nuclear technologies of electricity power plants, called a "Monjyu" policy debate (section 5.2). It is popular and famous among Japanese people, because Japanese government had made huge investment on one type of very promising nuclear power plant technologies (or a fast breeder reactor) "Monjyu" which was highly expected to enhance energy efficiency, compared to the existing one. Although there had been many debates and oppositions against Monjyu, Japanese government kept investing on it for long time without having the clear success. Therefore, the Monjyu project has remained very much controversial up to now since its start of 1960. In the retrospective treatment, we ask subjects to carefully read the Monjyu article and to write their requests about "what do you want people that lived 30 years ago to consider and do about Monjyu projects at individual and group levels if you can do so?" First, each subject is asked to write her individual request about the Monjyu

problem to the people who lived 30 years ago. Second, subjects are randomly matched to form a group of four people and asked to discuss and exchange the opinions about the possible requests. After that, each group writes and summarizes the request as well. We call this process as an intergenerational retrospective treatment because it gives another new perspective of judging what past people did to the current generation of the subjects in the experiments and inducing the subjects to think what should have been done if they were the people in past generations 30 years ago. We consider this process as part of acquisition or experiences of obtaining an intergenerational retrospective viewpoint.

In the retrospective treatment, subjects basically follow the same procedures of a case-method approach for forest management as in the non-retrospective treatment at individual and group levels except for the viewpoint they take in choosing the orders of preferences for policy options. First, each subject is asked to read and understand the case. Second, subjects are asked to choose the orders of preferences for the policy options of forest management in Kochi prefecture as an "initial choice" from a standpoint of the people who would live 30 years later from today (meaning the people that live in 2046). Next, we ask groups of four people to discuss and exchange ideas about what to do with forest management in Kochi prefecture for approximately 30 minutes again from a standpoint of the people who would live 30 years later (the people that live in 2046). After that, each group is asked to determine the order of preferences for the policy options as a group opinion without relying on majority voting as they are the people 30 years later from today. After the group discussions, each subject is asked to get back to the original position where they live "today" and to fill the order of preferences among the policy options to see whether individual preferences change before and after the group discussions as a "final choice" from a current generation's standpoint.

Overall, one session in the non-retrospective treatment consists of a case-method part of forest management for Kochi prefecture and a post-questionnaire collecting subjects' socio-demographic information, taking approximately 1 hour 30 minutes. One session in the retrospective treatment consists of an intergenerational retrospective part ("Monjyu"), a case-method part and a post-questionnaire, taking approximately 2 hours 30 minutes. We have run two sessions for each treatment, and approximately 36 subjects participated in one session. In total, the four sessions have been conducted and 144 local residents participated in the experiments. These subjects were recruited from the advertisements in lo-

cal newspapers or magazines, and they get paid 5000 Japanese yen for the participation per session. We randomly assign each subject to be in the non-retrospective or retrospective treatment, and a majority of subjects report that they enjoy participating in the experiments and are grateful to the opportunities of thinking and discussing an important policy agenda of Kochi forest management problems in their locality.

3 Results

Table 1 presents summary statistics of sociodemographic information and generativity scores for subjects. Approximately $70\,\%$ of subjects are female and the majority consists of people whose age is more than 40. This reflects the daily life and culture in Kochi prefecture in the sense that the population is aging and females are more attracted to participate in seminars or workshops that are held in universities or research institutes. Instead, young people do not have strong motivations to participate. Due to the fact that a majority of subjects are female in our experiment, the employment status in table 1 demonstrates that only $40\,\%$ of subjects are employed as a full-time or permanent worker. With respect to education and generativity scores, approximately half of subjects are the graduates from universities, and the generativity scores in subjects do not differ from those in other areas of Japan.

[Table 1 about here.]

Table 2 diplays the distributions of individual most favorite policies chosen by subjects per treatment for initial and final choices. It appears that there are some differences of distributions between non-retrospective and retrospective treatments in both initial and final choices (See the "frequency" and "percent" rows for initial and final choices in table 2). A notable difference between non-retrospective and retrospective treatments in both initial and final choices is about frequency of choosing policy options 3 and 4, while we do not find any obvious gap with respect to other policy options. In the non-retrospective treatment, a considerable portion of subjects choose policy options 3 and 4 as the most favorite policy. However, in the retrospective treatment, more subjects choose policy option 4 than policy option 3 as the most favorite policy.

To statistically confirm the difference, we run pairwise chi-squared tests of frequency distributions between non-retrospective and retrospective treatments for each of initial and final choices. The null hypothesis is that frequency distributions of non-retrospective and retrospective treatments for each of initial and final choices are the same. As of initial choice, the statistical difference of frequency distributions between non-retrospective and retrospective at 10 percent level is confirmed (See the last column of p-value of chi-squared tests in table 2 for the initial choice). As mentioned earlier, the result is mainly attributed to the difference of frequencies between policy options 3 and 4 in the initial choice. In the non-retrospective treatment, frequencies of policy options 3 and 4 are, respectively, 19 and 18, while those are 16 and 30.

[Table 2 about here.]

As of the final choice, the result of chi-squared tests shows the difference of statistical significance at 1 percent level (See the last column of p-value of chi-squared tests in table 2 for final choice and the corresponding p-value is 0,0076). The statistical significance in the final choice increases up to 1 percent level as compared with that in initial choice, mainly because the frequency of choosing policy option 3 almost as the most favorite policy doubles. That is, in the initial choice, the frequency of choosing policy option 3 is 19, while it increases up to 35 in the final choice. This implies that a considerable portion of subjects in the non-retrospective treatment affect the order of their policy preferences for policies in the way that the most favorite choice of policy options moves more toward policy option 3 at the final choice than at the initial choice.

To quantify the impact of the treatment in the experiment, we have further run logit regressions. In the regression, we classify the most favorite policy choices into two categories: When a subject chooses one of options 1, 2 and 3 as her most favorite, the choice is considered "status quo." When a subject chooses options 4 or 5 as the most favorite, it is "non-status quo." With this classification, we define a dependent variable in the logit regressions as a "non-status quo" dummy variable that takes 1 when a subject's most favorite choice falls into "non-status quo," otherwise 0. Independent variables in the regressions include age, gender, employment status, education and generativity scores. The logit regression confirm whether the treatment of intergenerational retrospective viewpoints affect the most

favorite policy choices made by subjects to be non-status quo or status quo, even after controlling for key sociodemographic factors and generativity scores.

[Table 3 about here.]

Model 1 in table 3 presents the results in the baseline logit regression. It demonstrates that the treatment dummy is statistically significant at $5\,\%$ level, while other independent variables are all insignificant. The odds ratio of the treatment dummy in model 1 is 2.32, implying that subjects under the treatment is more likely to choose non-status quo policies as the most favorite approximately by a factor of 2.32. This treatment impact in model 1 can be considered large enough to be economically significant. Although we have tried different types of regression analyses by changing a set of independent variables, we have consistently found that sociodemographic variables and generativity scores remain insignificant. Therefore, it is our belief that the baseline logit regression of model 1 is quite robust.

For further robustness check of the result in model 1, we have tried a different specification of regression by including the interaction between the treatment dummy and other variables in the regression. Models 2 and 3 in table 3 presents the result including the interaction variable between the treatment dummy and education. Consistently with the result in model 1, the result in models 2 and 3 demonstrate statistical and economic significance of the treatment dummy even with the interaction terms, while sociodemographic factors and generativity scores are statistically insignificant. In particular, the interaction term of the treatment dummy with education in models 2 and 3 consistently shows that subjects with high education are more likely to choose non-status quo policies as their most favorite under the treatment compared to the base group. The odds ratio is approximately 4.00 or 3, meaning that the impact of the treatment is significant. In the same way, the interaction term of the treatment dummy with low education is statistically significant at $10\,\%$ and the odds ratio is 2.64 in model 2. We have tried all possible combinations of interaction terms between the treatment dummy and other independent variables, however, the results are qualitatively same as the one in models 2 and 3. Overall, these results suggest that the impact of the treatment remains strong and significant for individual policy choices, irrespective of the model specifications.

4 Conclusion

We design and institute a deliberative experiment to test whether acquisition and experience of intergenerational retrospective viewpoints as one way of projecting future events affect individual preferences for policies. To this end, we employ a case-method approach for forest management policies in Kochi prefecture, Japan, because the forest management problems extend over multiple generations in nature. We prepare two treatments of non-retrospective and retrospective settings where subjects are asked to read through a case of forest management and reveal preferences for policies at individual and group levels through deliberative discussions. Subjects in the retrospective treatment go through a series of procedures to acquire intergenerational retrospective viewpoints, while those in the non-retrospective treatment do not. The results reveal that acquisition and experience of intergenerational retrospective viewpoints affect individual preferences for forest policies in the sense that the most favorite policies chosen by subjects in the retrospective treatment are different from those in the non-retrospective treatment. Subjects in the retrospective treatment have tendencies to choose the policies as the most favorite that fundamentally change status-quo for the possible betterment of future, while those in the non-retrospective treatment are opposite. Overall, this result suggests that some education or training for having intergenerational retrospective viewpoints as part of projecting future could affect the ways of thinking and preferences for the future policy debates.

We note several limitations and future directions of our study. First, our sample is more concentrated on elder people since young people are not so attracted to participate in workshops or field experiments in Japan, especially areas such as Kochi prefecture. However, field experiments in the future should try harder to collect young people more for generalizing our results. Second, the article published in the newspaper 30 years ago has been used to give an intergenerational retrospective viewpoint to subjects in this experiment. However, in reality, we think that there may be much better ways to effectively do the same. Future research should be able to address more effective and efficient ways for instructing intergenerational retrospective viewpoints. These caveats notwithstanding, it is our belief that this research is the first to design and institute a deliberative experiment for the future policies that extend over multiple generations and becomes an important first step to establish how an intergenerational

retrospective viewpoint is influential. We hope that further deliberative experiments ensue after this research for establishing a new mechanism to decide on future policies.

5 Appendix

5.1 A case of forest management problems in Kochi

5.1.1 A narrative account

It's Sunday. The sky spreads out clear and blue since morning.

- **Shokichi**: "The perfect weather for a walk!"

Shokichi makes it a habit to take a walk once every week to stay healthy. On sunny days like this, after having breakfast while reading the newspaper as usual, he would stroll around the premises of the castle until he got tired. As Shokichi was ascending the slope on the north side of the castle, someone called out to him from the top of the steps. Shokichi, with his cheerful disposition and wide circle of friends, often meets acquaintances by chance. It was Sachiko, one of his walking mates. Sachiko's hobby has been mountain climbing ever since she was young, and even now, she goes mountain climbing once a month. Shokichi searched for an interesting topic they could talk about, and recalled an article he had read that morning.

- **Shokichi**: "I read in today's newspaper that deer are causing serious damage in mountains recently."

Sachiko's expression suddenly became serious. This took Shokichi slightly by surprise.

- **Sachiko**: "About ten years ago, climbing mountains was like pushing through a thick green wall of trees and shrubs, and I could really feel the overflowing energy of the forest. But now, the only place I see greenery is overhead. All that is left on the ground is dry grass eaten by deerthough admittedly, that makes it easier to walk. There are a lot of dead trees too, since deer also eat trees. The forest's energy seems to be diminishing more and more, every time I go climbing."

- **Shokichi**: “I didn’t know that.”

- **Sachiko**: “I’m actually participating in a volunteer activity for deer damage prevention. Our next activity is on the second Sunday of next month. Wont you join us? We are going to Mt. Miune on the border between Kochi and Tokushima. I think you would have enough leg strength and stamina to handle it. It’d be a wonderful opportunity for you to see the state of the mountains.”

- **Shokichi**: “Is that so? I’d like to join then.”

Shokichi, who had never gone mountain climbing before, decided to join the volunteer activity simply because he thought it would be a good way to kill time. Although Sachiko noticed that Shokichi was not taking the matter as serious as she was, she didn’t mind.

On the day of the volunteer activity, Shokichi and Sachiko met at the Shikoku Shinrin Kanri-kyoku (Shikoku Forest Management Bureau). They got on a bus with the other participants, and headed to a piazza in the Monobe District where the opening ceremony was to be held. When they arrived, there were already several other buses and many people gathered in the parking lot. Shokichi was surprised to see the piazza overflowing with participants. Their ages varied, ranging from high school students to the elderly, and there were many women too (figure 1). It seemed like everyone besides Shokichi knew one another, so despite his outgoing character, Shokichi couldnt help feeling slightly out of place, and followed Sachiko around to join in on the conversations.

[Figure 1 about here.]

By the time they finished, descended the mountain, and returned to the piazza where the opening ceremony was held, the sun was beginning to set. Shokichi felt that the opening ceremony had taken place ages ago, rather than just a few hours back. On their bus ride back, Shokichi spoke to Sachiko.

- **Shokichi**: “To tell you the truth, when you invited me to this volunteer that day at the castle, I was assuming it would be like going on a hike or picnic...”

- **Sachiko**: “That’s alright. One can’t understand the serious situation of the mountains unless one actually sees it. Now it’s your turn to encourage as many people as you can to take notice of this situation.”

5.1.2 Why the sudden increase in feeding damage by deer?

Since the 1990s, it has been reported that deer damage has increased rapidly across JapanKochi Prefecture included. There are various theories for the cause. Among the various potential causes, Ryozo Yorimitsu, Honorary Professor at Kochi University states that the largest impact came from "changing life styles of people living in hilly and mountainous areas (namely, the downfall of communities in such areas)."[1] He argues that the ecosystem was disturbed due to the downturn in the forest industry, the depopulation in hilly and mountainous areas, and the fact that people no longer hunted for deer as a source of protein. If this is true, the environmental destruction of mountain forests by deer damage is most likely the consequence of Japan's post-war forest policies. Let us therefore review the environment surrounding Japan's post-war forest industry.

Prior to World War II, broad-leaved trees covered many of Japan's forests, and such forests were part of people's daily lives as they offered such necessities as sansai (mountain vegetables), firewood and coal. After the war, these mountain forests were replanted with coniferous trees, which grow faster, in response to surging demand for lumber. However, accompanying the growth of these coniferous trees, forest resources including sansai disappeared, leaving lumber as the only available resource (figure 4)

[Figure 2 about here.]

Thus, after the 1980s, when lumber prices began to decline due to the increase in cheap lumber imported from overseas and changes in the domestic housing landscape (figure 5).[2] People no longer found value in mountain forests. This was something that post-war mountain forest owners, who sought to turn their forests into coniferous forests, had not anticipated. We can concur that there was a decline in people associating themselves with mountain forests, as well as in deer hunters.

[Figure 3 about here.]

The fading interest in mountain forests is also corroborated by results of a survey targeting forest business managers (figure 6). Of all forest business managers, only $10\,\%$ earn revenue from selling lumber.

[1] Refer to the following website: http://nishigaki-lumber.co.jp/himorogi/bun/44.htm

[2] Source: "Sozai Kakaku Ruinen Tokei (Multi-Year Statistics on Material Prices)" in Mokuzai Jyukyu Hokokusho (Report on Lumber Supply and Demand in Japanese).

[Figure 4 about here.]

5.1.3 What actions should society take in 2017?

In section 5.1.1, we introduced a narrative about Shokichi and Sachiko who participated in a volunteer activity to prevent feeding damage. In section 5.1.2, we reviewed the transition of the environment surrounding forests from pre-war and post-war to now, with an aim to better understand the background of deer damage. Based on these premises, there are about five forest policy options that the current society can choose from.

Option 1 (Maintain the status quo) *Continue current forest measures, and not make significant investments for future growth. In artificial coniferous forests, neglecting forest management such as tree thinning can lead to deterioration in watershed protection and landslide prevention functions, thereby raising the risk of rainfall disasters. Also, as less people set foot on mountains, villages in hilly and mountainous areas may fall apart and end up vanishing. Consequently, forests may be divided into vast areas of unutilized forests, and utilized forests in the plains. In unutilized forests, the weaker trees will gradually die (or die all at once in locations prone to meteorological damage). Once that happens, the sunlight will reach the forest ground, and dormant seeds underground or seeds flying in the surrounding air would sprout, mainly growing into grass plants and broad-leaved trees. If the soil is degraded to the point that its foundation is lost, pine trees, which can adapt in wasteland, will grow.*

Option 2 (Intentionally neglect inefficient forests) *Only utilize forests that offer business benefits, while neglecting the rest. This option tries to achieve the outcomes expected in Option 1 (Maintain the Status Quo) at a faster rate. By immediately disinvesting in forests that would most likely not be utilized, or in villages that would most likely disappear, unnecessary investments can be prevented, but at the same time, this would also nip the bud of the thin thread of hope for forest restoration.*

Option 3 (Minimal management of inefficient forests) *Only utilize forests that offer business benefits, while neglecting the rest. However, regular tree thinning would be necessary in artificial coniferous forests, otherwise the functions of the forest that benefit the entire society, such as watershed prevention*

and landslide disaster prevention functions would deteriorate, leading to higher risk in rainfall disasters. Hence, investment would be made to replant all or part of the coniferous trees with broad-leaved trees. It should be noted that "neglecting management of artificial coniferous forests" is the least desirable option from the perspective of watershed protection and landslide disasters prevention functions. Also, the gap between "well-managed artificial coniferous forests" and "forests with both coniferous and broad-leaved trees or forests with only broad-leaved trees" is considered to be small.

Option 4 (Develop forest roads to sustain the forest industry) *Start developing forest roads through large public investments. The aim is to increase the efficiency of lumber transport and various silvicultural activities, thereby securing forestry's position as an industry. In addition, watershed protection and landslide disaster prevention functions will be sustained through continued management of artificial coniferous forests. It should be noted that developing such forest roads is costly since the roads will be used to transport very long and heavy lumber, and should therefore be designed to have gentle slopes and not too many sharp turns. The main, ring-route forest roads will be developed together with strip roads for respective logging areas (vehicle roads that have dead ends). This large public investment, once made, could potentially lead to sustained advancement of the forest industry, forest products industry, and related industries such as lumber processing, as well as to economic revitalization in the Kochi Prefecture.*

Option 5 (Convert to recreational mountain forest) *Develop and improve forest roads to improve access to forests, and also replace coniferous trees with broad-leaved trees. This would enhance the utilization of forests for purposes other than lumber (i.e., production of medicine materials, craft work materials including dyes, and food including sansai) which are currently depressed. This may lead to an increase in production of local specialty goods. Forests could be utilized for sightseeing purposes too (i.e., buggy trails, forest attractions and moss tours), helping revitalize Kochi Prefecture's economy. Note that the forest roads to be built are mostly in line with the main, ring-route forest roads mentioned in Option 4, making minimal management of artificial coniferous forests possible. However, extra investment will be necessary to build parking lots, pedestrian trails and bicycle trails in addition to the main forest roads.*

5.2 An article of the fast breeder reactor "Monjyu"

Monjyu is a fast breeder reactor that Japan had tried to successfully develop for the achievement of electricity self-sufficiency. This "Monjyu" technology in nuclear power plants is believed to be able to successfully and safely produce more nuclear fuels as byproducts than those used as inputs for electricity generation. The nuclear fuels are again used as inputs in the power plants. It is a "dream" technology. However, Japanese government announced that "Monjyu" projects got terminated in 2016, while research and development of such similar technologies shall be continued. All of the money spent on "Monjyu" can be considered wasteful at this point in time.

5.2.1 An opinion from person A: Steady efforts for "Monjyu"

Nuclear power plants were believed to be more economical than other types of power plants such as thermal power plants utilizing coal or petroleum. However, this belief has been betrayed by the fact that coal and other energy sources are becoming cheaper. However, should we care only about which energy is economical or cheap to choose electricity power plants?

Consider a scenario in which Japan has relied on thermal power plants and will do so in the future. In this case, Japanese people need to keep importing energy sources from foreign countries, implying that electricity fees we pay are becomes the payment to the foreign countries. On the other hand, consider a scenario in which Japan successfully develop electricity power plants equipped with "Monjyu." In this case, electricity fees we pay become the contribution to the profit of Japanese companies, because "Monjyu" is a promising technology and capital that Japanese companies provide for electricity. In summary, if Japan relies on thermal plants, we need to keep paying money to foreign countries. If Japan successfully develop "Monjyu," it will more contribute to the national economy with less payment to foreign countries.

At this point in time, it appears that research and development for "Monjyu" seem not to be attractive, because other energy sources are becoming cheaper. However, we should not change our mind facing such trends. "Monjyu" is an attractive option to pursue in consideration of its contribution to national economy, enabling to self-produce and self-consume electricity. In the long run, "Monjyu" shall be a technology that helps and supports Japanese economy due to its promising properties as a

technology for nuclear power plants.

5.2.2 An opinion from person B: No need of nuclear power plants

It is a hot debate about whether Japan further pursue research and development of nuclear power plants for electricity, because of the recent trends that other energy sources are becoming cheaper. When other energy sources such as coal or petroleum are cheap, Japan should not rely on nuclear technologies for electricity, considering huge risk in accidents and their associated problems.

In particular, not only nuclear power plants' accidents but also radioactive wastes could be huge concerns in the future of Japanese economies because Japan is a small country surrounded by seas. Once a huge accident related to nuclear power plants occur in Japan, such adverse effects such as radiation pollution will be irreversible damages in many ways. Considering the aforementioned risk in nuclear technologies for electricity, I think that Japan should shift its efforts and attention to more promising and less risky energy sources such as renewable ones, solar and hydro power plants. I believe that changing the policy of electricity generations toward developing renewable energy is necessary. Once nuclear power plants' accidents occur, it is too late and irreversible. We should recall "one is always sorry after the event."

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List of Figures

Figure 1: Opening ceremony at a piazza in Monobe

The participants got on the bus once again, and were dropped off at the entrance of a hiking trail. Everyone hauled their luggage and started climbing the trail. Shokichi glanced up at the sky. He could see sunlight seeping in through the green trees, and a pleasant feeling swept over him. Just then, the staff member leading the group made everyone halt. There was no greenery on the ground on which they were standingonly withered bamboo stems growing like pins. The staff took out a photo and started explaining (figures 2(a) and 2(b))

- **Staff**: "10 years ago, this area was covered with fresh green bamboo. See that large rock over there, about two meters high? You couldn't even see that rock from here since it was hidden by all the bamboo. This is a photo that was taken here 10 years ago. Back then, we had to push our way through the thick bamboo."

However, over the past decade, deer had eaten up all the bamboo. So the ground became exposed, causing surface runoff from rainfall to increase. This place, where the staff made everyone stand, was a place symbolizing environmental destruction of the mountains in the vicinity. Shokichi was slightly shockednot about the drastic environmental change that had occurred over the past decade, but about his ignorance for not noticing any of the drastic changes taking place around him.

After walking a bit farther, they arrived at the location where the activity was to take place. That day's activity was to set up a net to prevent feeding damage. On the surface of trees, there is an important tissue called the cambium layer which transports water and nutrients. When this tissue is eaten by animals, water and nutrients cannot be transported above or below that area, causing most trees to die. The area where they were standing had received severe feeding damage, and there were virtually no living trees left. Their mission was to set up a net to prevent feeding damage (figure 3). The volunteers first determined a starting point, then dug stake holes at equal intervals, drove in the stakes, and set up the net using clamps. They also added reinforcement materials on the hem of the net. Since the net had wires in it and was quite heavy, working on a steep hill was more difficult than Shokichi had expected.

Figure 2: Current forests and forest in old times at Kochi

(a) Comparing the current state with an old photo

(b) Closeup of the old photo

Figure 3: Setting up the feeding damage prevention net

Figure 4: Temporal changes in Japan's forests

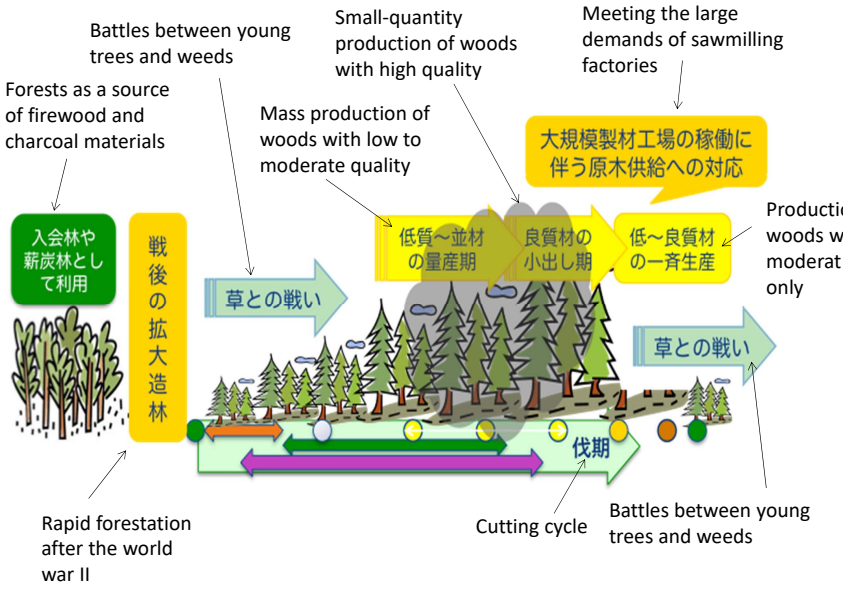


Figure 5: Temporal changes in lumber price

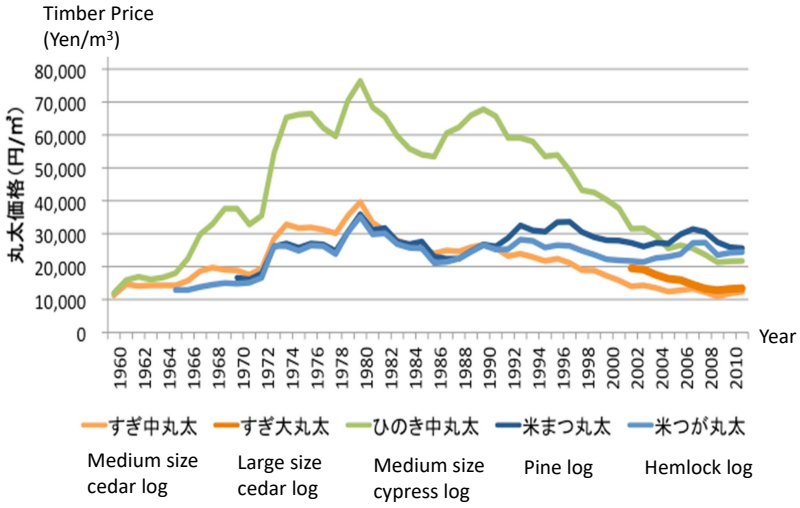
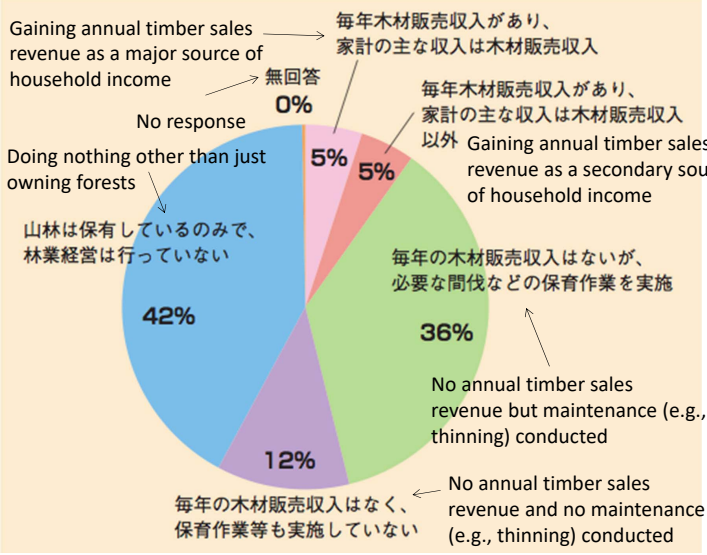


Figure 6: Results of survey to forest business managers. Source: Ministry of Agriculture, Forestry and Fisheries, Ringyo Keiei Ni Kansuru Iko Chosa (Survey on Forest Management), March 2011 (in Japanese)



List of Tables

Table 1: The summary statistics of sociodemographic data for subjects

Independent variables	# of observations	Percent (%)	Mean	SD
Gender				
Male	47	30.3		
Female	108	69.7		
Age				
Age $\leq$ 39	51	32.9		
Age $\leq$ 40-59	63	40.6		
Age $\geq$ 60	41	26.5		
Employment status				
Full time and permanent	61	39.4		
Others	94	60.6		
Education				
Undergraduate or graduate degree in the university	76	49.0		
Others	79	51.0		
GBC score[1]			25.8	12.4

[1] The GBC stands for generative behavioral checklist whose score ranges between 0 and 40.

Table 2: Distributions of individual most favorite policies chosen by subjects per treatment

	Non-retrospective						Retrospective						p-value[1]
Policy option	1	2	3	4	5	Total	1	2	3	4	5	Total	
Initial choice													
Frequency	2	7	19	18	32	78	0	2	16	30	29	77	0.1062
Percent	2.6	9.0	24.4	23.1	41.0	100.0	0.0	2.6	20.8	39.0	37.7	100.0	
Final choice[2]													
Frequency	0	2	35	15	25	77[3]	2	4	17	30	24	77	0.0076
Percent	0.0	2.6	45.5	19.5	32.5	100.0	2.6	5.2	22.1	39.1	31.2	100.0	

[1] It is p-value in chi-squared tests of independence for frequency distributions between non-retrospective and retrospective treatments

[2] It is the choice after the group discussions.

[3] One subject has not properly answered preferences for final choice in non-retrospective treatment, and the subject's observation is removed for the analysis. Therefore, the total observations become 77 for final choice in non-retrospective treatment.

Policy option 1 is maintenance of status quo.
Policy option 2 is intentional abandonment of economically inefficient forests.
Policy option 3 is minimum care for economically inefficient forests.
Policy option 4 is installation of forest roads for the sustainability of forests.
Policy option 5 is transition toward recreation forests.

Table 3: Logit regression results

Independent variables	Model 1			Model 2			Model 3		
	B	s.e.	OR[1]	B	s.e.	OR	B	s.e.	OR
Treatment dummy									
Treatment $= 0$	(Base group)						(Base group)		
Treatment $= 1$	0.84**	0.35	2.32						
Treatment $= 0 \times$ Education $=$ High				(Base group)					
Treatment $= 0 \times$ Education $=$ Low				0.64	0.48	1.90			
Treatment $= 1 \times$ Education $=$ High				1.38***	0.51	3.97	1.04**	0.44	2.84
Treatment $= 1 \times$ Education $=$ Low				0.97*	0.51	2.64	0.62	0.43	1.85
Age									
Age ≤ 39	(Base group)			(Base group)			(Base group)		
Age $=$ 40-59	0.56	0.42	1.75	0.54	0.42	1.72	0.52	0.42	1.69
Age ≥ 60	0.27	0.45	1.31	0.27	0.45	1.31	0.24	0.45	1.28
Male	0.35	0.40	1.42	0.36	0.41	1.43	0.28	0.39	1.19
Full time and permanent	0.17	0.37	1.19	0.20	0.37	1.22	0.18	0.37	0.71
Education $=$ High	-0.16	0.35	0.85	-	-	-	-	-	-
Generativity $=$ High	-0.29	0.35	0.75	-0.30	0.36	0.74	-0.34	0.35	0.71

***significant at 1 %, **significant at 5 % and *significant at 10 %.

[1] The "OR" stands for an odds ratio in logit regressions.