令和5年度特色入試問題

《農学部 森林科学科》

小論文試験

200点満点

（注　意）

1. 問題冊子および解答冊子は係員の指示があるまで開かないこと。
2. 問題冊子は表紙のほかに8ページある。
3. 解答冊子は表紙のほかに12ページある。なお，別に下書き用紙12ページを配布する。
4. 試験開始後，解答冊子の表紙所定欄に受験番号・氏名をはっきり記入すること。
   表紙には，これら以外のことを書いてはならない。
5. 解答はすべて解答冊子の指定された箇所に記入すること。
6. 解答に関係のないことを書いた答案は無効にすることがある。
7. 解答冊子は，どのページも切り離してはならない。
8. 問題冊子および下書き用紙は持ち帰ること。解答冊子は持ち帰ってはならない。
9. 解答は日本語で記入すること。

問題１　以下の英文を読み、問１～４について、解答用紙の所定の欄に収まるように答えなさい。（100 点）

The world's forests—which today cover 30% of the earth's land surface— are an incredibly valuable resource, storing massive amounts of carbon, helping to purify[*1] water and air, ensuring natural biodiversity, and providing livelihoods[*2] for millions of people. But despite the vital importance of forests, they are under worldwide assault, with the equivalent of 30 soccer fields disappearing every minute.

In response to the growing crisis, Boston Consulting Group conducted a comprehensive analysis to answer three questions: What is the financial value of global forests? ①What are the biggest threats to that value? How and to what extent can we preserve (or even increase) the value of forests?

②Our analysis addresses the value of forests across four attributes: their climate regulatory function; their environmental benefits, such as air purification and water filtration[*3]; their commercial output; and their social value. We realize that quantification[*4] of these dimensions is difficult, and certainly always imperfect. For example, the value of forest biodiversity cannot fully be captured. Nevertheless, ③we believe that a valuation[*5] is essential in order to create transparency with respect to the value of forests in comparison with other assets[*6] and thereby introduce clarity to a discussion that is often dominated by emotion.

Among our findings:

- The estimated total value of the world's forests is as much as $150 trillion[*7]—nearly double the value of global stock markets. The ability of forests to regulate the climate through carbon storage is by far the largest component of that total value, accounting for as much as 90%.
- The most serious threats are not always the ones garnering[*8] the most public attention. Recent media coverage, for example, has intensely[*9] focused on the devastation[*10] brought by wildfires[*11]. However, our analysis finds that land use changes and rising global temperatures, major drivers of deforestation[*12], will actually be the main causes of forest value losses. Of the five primary threats to forest value that we identified, these two account for about 70% of projected losses between now and 2050. Ultimately, if the five

major threats to forests today are not addressed, global forest value will drop by roughly 30% by 2050.

- All stakeholders[*13], including governments, NGOs, the private sector, and consumers, have a role to play. Governments are particularly important and must create a robust regulatory framework that drives real change. We have identified six critical actions that can protect forests and limit deforestation—and therefore preserve forest value: ④ (a) restore and plant forests for the purpose of protection as well as wood production, sustainably manage these and more of the existing forests, and increase their productivity; (b) boost sustainable and productive agriculture; (c) reduce meat consumption; (d) push for deforestation-free production of palm oil, soy, beef, and timber; (e) increase wood recycling; and (f) limit global temperature increase to less than 2°C. Ambitious but realistic action, including follow-through[*14] on current global pledges[*15] for forest protection, can preserve 20% of value and thus reduce value loss to about 10% by 2050.

語注： *1 purify: 浄化する、*2 livelihood: 暮らし・生計、*3 filtration: 浄化、*4 quantification: 定量 *5 valuation: 査定・評価すること、 *6 asset: 資産、*7 trillion: 兆、*8 garner: 獲得する、*9 intensely: 強く、*10 devastation: 荒廃・惨状、*11 wildfire: 野火、*12 deforestation: 森林伐採・森林破壊、*13 stakeholder: 利害関係者、*14 follow-through: 最後まで続けること、*15 pledge: 誓約・公約

出典：Kappen, G., Kastner, E., Kurth, T., Puetz, J., Reinhardt, A. and Soininen, J. (2020), The staggering value of forests—and how to save them. Boston Consulting Group. (https://www.bcg.com/publications/2020/the-staggering-value-of-forests-and-how-to-save-them、2022 年 5 月 17 日参照) より一部改変・抜粋

問１　下線部①に関して、何が森林の価値を損なう主な脅威であるか、本文中に述べられていることを説明しなさい。

問２　下線部②に関して、本文では森林の価値を４つの特性に分けている。それぞれの特性について、あなたが知っていることを述べなさい。

問３　下線部③を日本語に訳しなさい。

問４　下線部④で述べられている６つの行動 (a) ～ (f) が、なぜ森林の価値を守ることにつながるのか、そして、それぞれの行動について、今後どのような regulatory framework（法制度・規制枠組み）が必要かについて、あなたの考えを述べなさい。なお、問４の解答用紙 (a) ～ (f) に、６つの行動 (a) ～ (f) についての解答をそれぞれ記入しなさい。

白　紙

問題２　A はフィンランドにおける森林産物の利用状況について紹介した文章である。B はフィンランドの木材利用の流れを示した図である。これらに関する問１～５について、解答用紙の所定の欄に収まるように答えなさい。（100 点）

A.　フィンランドにおける森林産物の利用状況

The annual growth of Finnish forests has nearly doubled since the 1950s, and so has the amount of wood that can be sustainably extracted from these forests. Less than half of all wood extracted is used for heat and power, while more than half is converted to products. Together, the unextracted forest growth and durable[*1] products, which continue to store carbon for years or decades, are equivalent to over half the roundwood harvest. Typically, wood energy resources are used in highly efficient district heating (DH) systems[*2] and combined heat and power (CHP) plants[*3].

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Three case studies, located as shown in Figure 1, provide useful insights for policy makers on the value of increased scale and flexibility in energy conversion when planning and implementing[*4] bioenergy strategies. One case, in southern Finland, illustrates biomass use in a municipality[*5] to which biomass is transported from forests. Cases in central and eastern Finland illustrate the integration of biomass supply with local forest industries. The advanced CHP plants highlighted here can use a wide range biomass from forests. This means greater flexibility in timing and sourcing feedstock collection, and hence lower costs.

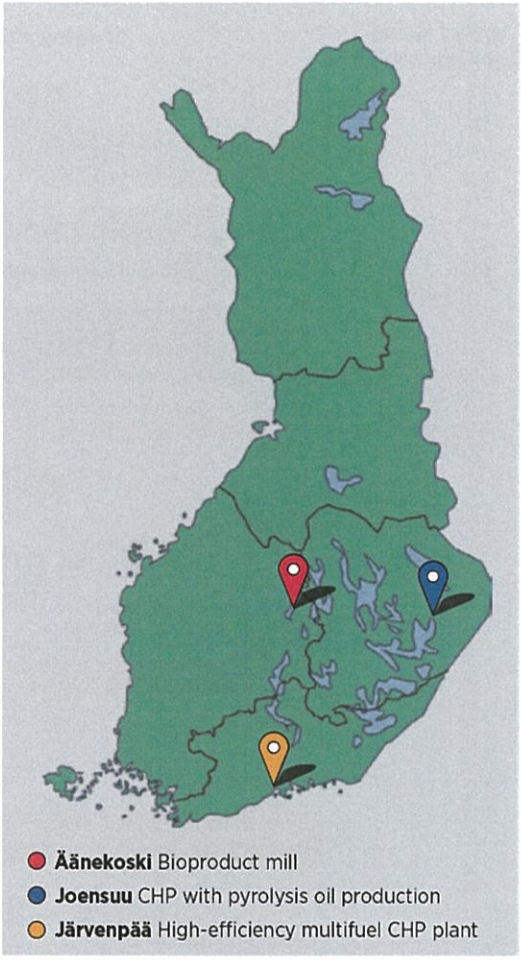
The first case study examines Metsä Fibre's new bioproduct mill[*6] in Äänekoski in central Finland. This mill, fuelled by various wood residues, is much more energy efficient than typical pulp mills fuelled by fuel oil. ①The bioproduct mill uses 100% renewable energy sources. It is optimised to produce electricity for the bioproduct mill, the Nordic power market and district heat for the neighbouring town and industries. On top of standard products such as pulp, tall oil[*7], bark, turpentine[*8], electricity and process steam, the mill can make high-value-added bioproducts such as textile fibres, biocomposites, fertilisers, biofuels and lignin[*9] upgrades in collaboration with local partners. ②Such an integrated production strategy provides new avenues for renewable energy uptake.

The second case study describes a high-efficiency multifuel CHP plant at Järvenpää, in southern Finland, owned by the electric utility Fortum. In 2014, the plant operated with 99.5% biomass fuels ③ at 96.5% efficiency. Such extremely high efficiency is made possible by a flue gas condenser[*10], which enables the plant to capture energy from moist fuel that would otherwise be wasted through evaporating[*11] the inherent[*12] water content of such fuel. The plant can also use residues, such as farmyard manure[*13], for up to 30% of its fuel.

・・・・・・(中 略)・・・・・・

The third case looks at a pyrolysis oil[*14] plant connected to a CHP plant at Joensuu in eastern Finland, also owned by Fortum. Pyrolised fuel is produced at high efficiency from forest residues and sawdust, which are by-products of the local forest industry. A fluidised bed boiler[*15] acts as a heat source for pyrolysis, and the coke[*16] and uncondensed gases from pyrolysis are used to generate additional heat and electricity. ④ The case thus demonstrates how fuel production can be made more cost-effective by integrating it with heat and power production.

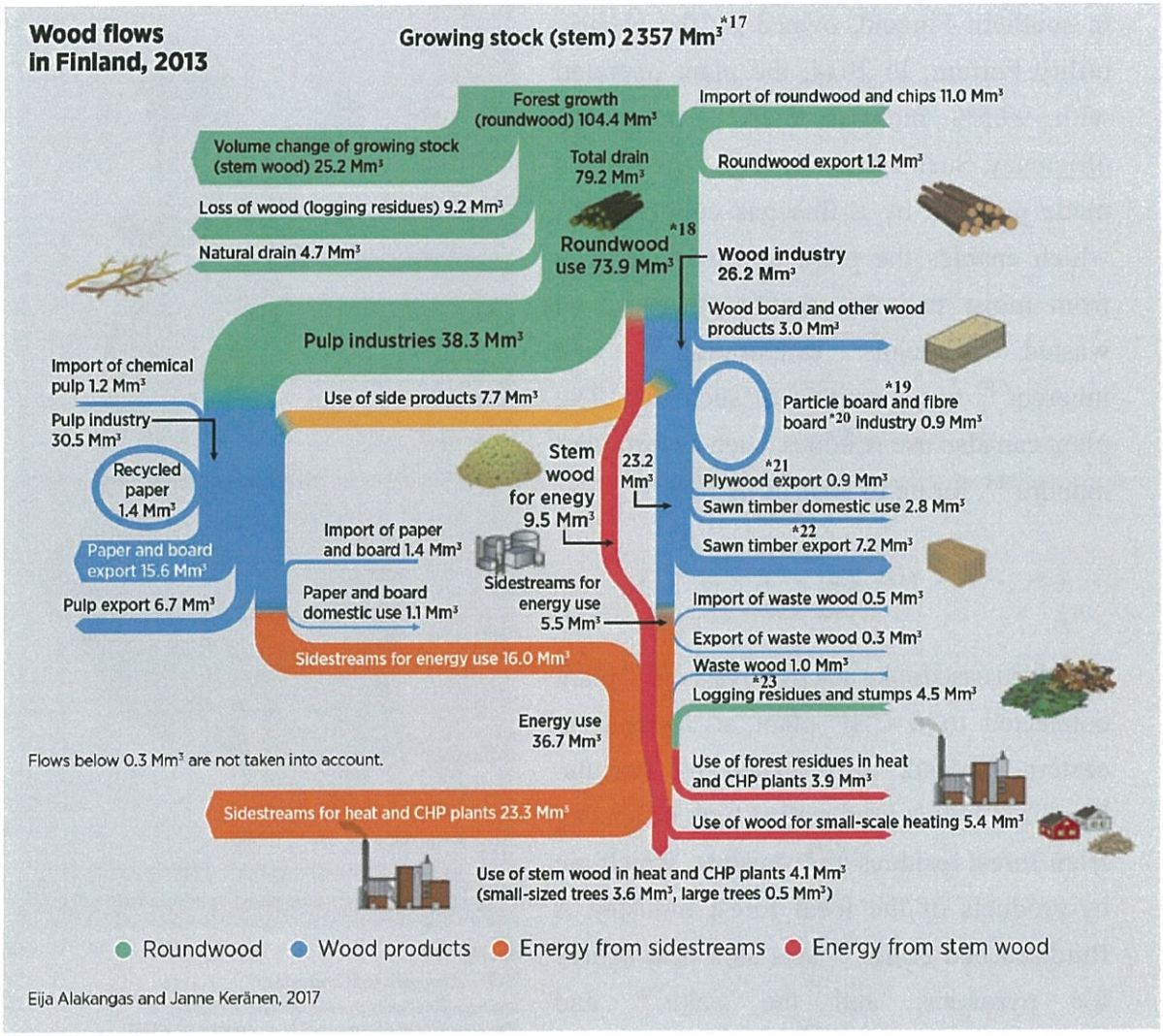
Figure 1 Case studies in southern, central and eastern Finland



Source: VTT
CHP = combined heat and power
The boundaries and names shown on this map do not imply any official endorsement or acceptance by IRENA.

語注： *1 durable：耐久性のある、*2 district heating (DH) system：地域暖房システム（ある地域内の住宅、公共施設、産業施設などに、蒸気または熱水を配管を通じて供給する暖房システム）、*3 combined heat and power (CHP) plant：熱併給型の発電プラント、*4 implementing：実行する、*5 municipality：地方自治体、*6 mill：工場、*7 tall oil：トール油、*8 turpentine：テレビン油、*9 lignin：リグニン（木材の主要構成成分のひとつ）、*10 condenser：復水器（水蒸気を液体の水にする装置）、*11 evaporate：蒸発させる、*12 inherent：固有の・持ち備えている、*13 manure：糞尿、*14 pyrolysis oil：熱分解油（熱分解により得られる油）、*15 fluidised bed boiler：流動床ボイラー（砂などの細かな粒子を用いて加熱するボイラー）、*16 coke：炭

B. フィンランドにおける木材利用の流れ



Note: Red and orange show energy use. Yellow shows sawmill residues used as raw material. Blue shows different wood-based products. Green shows roundwood (not processed wood).

Source: VTT

語注：*17 Mm^3：メガ立方メートル（メガ= 10^6）、*18 roundwood：丸太、*19 particle board：パーティクルボード（木材の細片を接着剤で熱圧成形した板材）、*20 fibre board：ファイバーボード（細かい木材の繊維を接着剤で熱圧成形した板材）、*21 plywood：合板、*22 sawn timber：製材、*23 logging：伐採

出典：IRENA (2018), Bioenergy from Finnish forests: Sustainable, efficient and modern use of wood, International Renewable Energy Agency, Abu Dhabi. (https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Mar/IRENA_Bioenergy_from_Finnish_forests_2018.pdf、2022 年 6 月 22 日参照) P6-7、10 より一部改変・抜粋 (A: P6-7、B: P10)

問１　下線部①および④を日本語に訳しなさい。

問２　下線部②について具体的に説明しなさい。

問３　下線部③について、復水器（condenser）を用いることでなぜ効率が 96.5% と高くなるのかを説明し、このシステムがどのようなバイオ燃料に有利になると述べられているか、答えなさい。

問４　B.フィンランドにおける木材利用の流れの図に関する以下の設問（１）～（２）に答えなさい。

（１）フィンランドにおいて、木材がパルプ工業および木材工業で利用されるまでの過程を図の数値を用いて説明しなさい。

（２）フィンランドにおける木材のエネルギー利用について、図の数値を用いて説明しなさい。

問５　フィンランドの森林産物の利用状況を踏まえて、あなたの考える日本における今後の森林産物利用のあり方について論じなさい。

令和５年度 特色

問題訂正
（農学部　森林科学科　小論文試験）

下記の問題訂正があります。

記

問　題　訂　正

農学部 森林科学科 小論文試験　問題冊子

問題１
２ページ
　語注　１行目
　　（誤）…、*4 quantification: 定量 *5

　　↓

　　（正）…、*4 quantification: 定量、 *5

以上