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| FSM | Questions |
| 2472.02 OBJECTIVES2472.03 POLICY(2) Apply genetic principles to all silvicultural prescriptions…restore climatically and genetically appropriate native plant material. Non-native, non-invasive plant species may be used when:* Non-native, non-invasive plant species may be used when:
	1. Needed in emergency conditions to protect basic resource values,
	2. As an interim, non-persistent measure designed to aid in the re-establishment of native plants,
	3. When native plant materials are not available, and
	4. In permanently altered plant communities.

(3) Use climate appropriate and available genetically improved seed and planting stock. Do not use seed or seedlings of exotic tree species, except where: a. Scientific studies show they are  adaptable. b. Administrative studies or evaluation tests are being carefully planned and monitored with advice, cooperation, or assistance from qualified research scientists. (4) Seed and planting stock of native species from an offsite source may be used to accommodate projected changes in climate when a science-based risk analysis indicates the current seed zones may result in maladapted forests due to climate change (FSM 2475.03). Justification for assisted migration to be implemented should be documented in silvicultural prescriptions and tracked in the appropriate system of record.1. Maintain appropriate genetic diversity including multiple species and diverse seed sources in the reproductive material used to restock National Forest System lands to minimize inbreeding or outbreeding depression, ensure evolutionary potential and increase ecological resilience.

(10) Consider using plant materials from genetically modified trees (GM trees, Level 6, see FSM 2475.36) when they can help to mitigate a forest health threat, such as restoring a native species extirpated by insects or pathogens. GM trees may only be used under permit from appropriate regulatory agencies (for example, USDA-APHIS, EPA, FDA) or if they are exempt or de-regulated by these agencies and after approval is granted by the Regional Forester. Monitoring protocols must be established to track survival and performance of plant materials from GM trees.(11) Develop all phases of genetic resource management through close cooperation of Research and Development, State, Private and Tribal Forestry, and National Forest System staffs. (21) Consider assisted migration to accommodate projected changes in climate when a risk analysis indicates the local seed zones may result in maladapted forests due to climate change. Use a diverse set of plant materials that are adapted to current local environmental conditions, as well as environmental conditions projected 20 to 50 years in the future. When considering assisted migration, a science-based assessment and analysis including geographic, physiographic, and edaphic factors, as well as biotic interactions must be conducted to evaluate whether seed sourcing based on current seed zones may increase the risk of maladaptation.(22) Consider using plant materials from genetically modified trees (GM trees, Level 6, see FSM 2475.36) when they can help to mitigate a forest health threat, such as restoring a native species extirpated by insects or pathogens. GM trees may only be used under permit from appropriate regulatory agencies (for example, USDA-APHIS, EPA, FDA) or if they are exempt or de-regulated by these agencies and after approval is granted by the Regional Forester. Monitoring protocols must be established to track survival and **performance** of plant materials from GM trees.GLOSSARY**Assisted migration trial**. A test designed specifically to determine what seed sources (in terms of past and present climate zones) will be most appropriate for projected future climates.**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***2475.35 - Level 5, Selective Breeding and Rogued Seed Orchards Selective breeding involves the production of seed of known parentage to provide an improved base population from which to select materials for advanced generation seed orchards. Trees may be selected for: apparent resistance to insects or diseases, resistance to drought or cold, rapid growth, and/or quality of forest products that can be produced from them. Parents included in initial breeding programs may have been selected only because of their excellent appearance (phenotype).As programs advance, selections should be based on their genetic value as determined through progeny testing or clone testing. Seed produced in seed orchards that have been rogued based on progeny or clone tests should be included in this level.2475.36 – Level 6, Trees Derived from hybridization with non-native species. 2475.36 - Level 6, Trees Derived from BiotechnologyTrees derived through biotechnology ~~(Biotech trees~~) should provide special attributes that are not readily available through selective breeding (Level 5). These attributes may include resistance to insects or diseases and tolerance to drought, heat, cold or adverse soil conditions. Additional attributes could impact growth rate, tree form or wood quality. Similar considerations for climate- and site-adaptability and genetic diversity should be used for Biotech trees as for trees under Levels 1 to 5. | A. Does NFMA define appropriate forest cover to permit level 6?Native plant materials: [Forest Service Native Plant Materials Policy and Authorities (usda.gov)](https://www.fs.usda.gov/wildflowers/Native_Plant_Materials/policy.shtml)Stipulates … plant materials that evolved naturally in a defined native ecosystem. B. Can native GMO or non-native, non-invasive GMO or hybrids with non-native species be used under this standard? C. We suggest a policy standard such that the best available (highest level) planting materials are always preferred up to and including level 5, but that above level 5, the lowest level that can meet management objectives be employed, i.e., level 6 or level 7 (as NEWLY defined) materials are deployed only when a lower level is inadequate to meet objectives. D. Does this AND mean AND or is OR intended? E. See proposed addition of Level 6 related to use of exotics in hybrid production. F. What analysis is correct?G. What phenotypic changes represent ‘maladaptation’ and what thresholds represent acceptable outcome? Will a survival standard be used? A growth and yield model? An ecological model based on niche occupancy? H. It should be included that germplasm assessment and germplasm diversity are essential for the success of all levels, but especially higher levels, which will often be employed when species are in decline.1. What level of demographic or regional decline will trigger germplasm collection?
2. What standards for germplasm collection and management will be used?
3. What level of genetic diversity is appropriate for a native parent in a level 6 orchard? For example, are F1 hybrids acceptable?
4. What range of the genetic diversity of the native parent should be incorporated in orchards at level 5 or higher?

I. The meaning of extirpated is unclear – the text should say locally or regionally extirpated, or similar. 1. Is level 6 or 7 justified when known threats cannot be mitigated using any other means?
2. What standard trigger consultation with USFWS or USEPA?
3. Is range-wide susceptibility to lethal or debilitating disease sufficient to trigger action? Or some other standard such as loss from X% of range?

J. Cooperation and perhaps consultation with Tribes and other groups should accompany deployment at Levels 6 and 7. K. See (G) above--what standards indicate maladaptation?Should risk analysis include risk of non-action?What are thresholds? Are there triggers or red flags? Risk to whom, and when, and what kind of risk?Will forest management plans be modified to accommodate the introduced species?  L. Modify to be (new) level 6 (hybrids) and level 7. M. Again, what level of threat is a trigger for action. Local or regional extirpation? Loss of breeding adults? Immanent demographic collapse? Loss of ecological function? Performance may need clarification. Is performance defined as fulfilling an *ecological* function *in accord with the intent of the production and deployment* of the GM tree? N. WHEN trees corresponding to Level 6 or Level 7 are discovered naturally regenerating on NFS lands WHERE THEY HAVE NOT BEEN APPROVED FOR USE, will they be removed? Is climate the only relevant variable? Soil? Competition? Cultural considerations? Management capacity? Adaptation is larger than moving propagules. Consider changing to read that the seed sources should be most appropriate for meeting management objectives including climate adaptation? Such as statement might include Assisted Migration to ensure a food source is present to support wildlife, to maintain soil stability following disturbance, or fill a niche abandoned by a species lost to climate change. \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*We suggest this category include breeding and selection using hybrids with native species and hybrids with non-native, non-invasive species. The non-native species or the hybrid must be already on the landscape and shown to present no other known risks to native species, including introduction of susceptibility to disease or pests, or genetic swamping of the native species. Hybrid seeds in level 5 are produced using controlled or open pollination. Hybrids at this level are produced and deployed only when non-hybrids are unable to meet management objectives. We suggest the insertion of this level between Level 5 and former Level 6. This level is used only when trees produced from Level 5 cannot meet management objectives. This Level includes trees produced using interspecific hybridization between native and non-native species when the non-native species is not already present on the landscape, or when hybrids with the non-native are not already present. The hybrid and the non-native parent must be shown to be non-weedy and non-invasive. These hybrids may be produced using non-classical means (e.g., embryo rescue) or by controlled or open pollination. This level also includes any hybrids that represent a threat to form a syngameon with a third species, hybrids that have known pest or disease susceptibility, or hybrids that will likely spread beyond the original range of the native parent. When the native species is in danger of local or wider extirpation, a germplasm assessment and collection must take place, and consultation with regulatory agencies must precede deployment. All trees from breeding programs or seed orchards containing hybrids at level 6 are considered level 6.This Level is appropriate only if lower levels cannot meet management objectives.We suggest this level will become level **7.**1. Biotechnology should be changed to genetic modification because the definition of biotechnology in FSM includes methods such as gene mapping or genomic selection that are versions of classical genetics that are appropriate for level 5.
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