The ecophysiological characteristics of *Alnus hirsuta* Trucz., *Populus alba* L., and *Taxodium distichum* L. saplings under flooding conditions were researched. The saplings of these species were exposed to the flooding conditions at different water levels. Flooding treatments were started both in the early growing season and in the late growing season to explain effects of the flooding season on the plant species. Then their physiological responses, growth patterns and their tolerance in the flooding stress were analyzed and discussed.

Under the flooding condition, reduction in the net photosynthesis and stomatal conductance were observed in the *P. alba* saplings because of the oxygen and water deficiency. Then, *P. alba* saplings developed adventitious roots on the submerged part of the stems to compensate oxygen and water deficiency. Number and length of the adventitious roots increased with water depth proportionally. However, these interactions affected leaves emergence and leaf expansion, and reduction in the total leaf area of *P. alba* saplings were observed earlier period of the flooding and it increased significantly by the time. As the results, less total leaf area caused less photosynthesis and less production. Therefore apical growth and lateral growth of the *P. alba* saplings reduced under the flooding condition.

In the *A. hirsuta* saplings flooding caused reduction in the net photosynthesis and stomatal conductance immediately, and adventitious roots were observed on the submerged part of the stems under depth water flooding condition. However new leaves emergence and expansion were slowed down under the flooding condition and these interaction were affected also the net photosynthesis rate. Then root-shoot balance changed and flooding affected apical and lateral growth of the *A. hirsuta* saplings. Therefore reductions were observed on growth of the above ground part of the *A. hirsuta* saplings.

In the *T. distichum* saplings, morphological changes were observed on the submerged part of the stems and developed aerenchema tissues to compensate oxygen and water deficiency. In the *T. distichum* saplings reduction in the total leaf area was not observed in the earlier period. In this way, net photosynthesis did not reduced earlier period of the flooding. Therefore growth reductions were not observed immediately. However, in the *T. distichum* saplings effects of the flooding were observed in continuous flooding conditions.
論文審査結果の要旨

本研究は、湛水地の緑化を目的として、ヌマスギ、ギンドロ、ハンノキ、ケヤマハンノキの4樹種の湛水ストレスに対する耐性を生理生態学的に検討したものである。これらの樹種はいずれも湛水地に生育するが、止水と流水の違いなど好む生育立地には違いがある。

ヌマスギとハンノキの苗木を用いて、湛水深を4段階に変えて1年間生育させたところ、ハンノキは湛水深が深くなるほど成長が抑制されたが、ヌマスギでは影響は認められなかった。またハンノキでは、湛水深が深くなると種子生産する個体数が増加し、湛水が深くなるにつれストレスが強くなっていると考えられた。

ヌマスギ、ギンドロ、ケヤマハンノキの苗木を2段階の湛水深で生育させた。いずれの樹種も湛水しない場合より成長量が抑制されたが、ヌマスギは樹高成長だけ、ケヤマハンノキは樹高と枝張り成長、ギンドロは樹高、直径、枝張りの成長が抑制された。ケヤマハンノキは湛水深が深く最大光合成速度が大きく、個体あたりの葉面積が小さいが、ギンドロとヌマスギは最大光合成速度も葉面積も変わらなかった。また、いずれの樹種でも生産量は湛水深に関わらず同じであった。湛水深が深い状態で高い生産力を維持するために、ギンドロとケヤマハンノキは幹から不定根を発達させ、ヌマスギは幹に通気組織を発達した。

従来から、これらの樹種の自生地における適応は注目されてきており、本研究は湛水ストレスに対するこれらの樹種の生理生態学的特性の違いを明らかにした。これらの知見は湛水条件に生育する樹種の適応を考える上でも示唆を与え、湛水地における緑化手法にとっても、樹種選択や植栽方法に有用な情報をもたらすものと考えられる。したがって、本論文は博士(学術)に値する論文であると判定した。