2-11. Application of Artificial Neural Networks for Hazard Assessment of Pine Trees Caused by Forest Insect Pest

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Two different artificial neural networks, unsupervised and supervised neural networks, were applied for assessing hazard of forest trees caused by forest insect pest. The data representing characteristics of pine trees such as D.B.H., tree height, crown length, crown width, crown form, crown area, and crown volume were measured from dead and recovering trees of 251 in the pine forest damaged seriously by the pine needle gall midge in the study area of Yangyang-gun, Kangwon-do. The measurement were carried out after three year of damage peak, thus trees showed their physiological status whether they are recovering or not from the serious damage caused by the pine needle gall midge.

The modeling procedure was carried out following two steps. First, the data were analyzed using self-organizing map (SOM), an unsupervised neural network, which allowed classifying sampling trees according to characteristics of trees. Second, a backpropagation algorithm (BP), a supervised neural network, was applied to predict the probability of recovering from the serious damage caused by the midge. 167 sampling trees out of 251 were used to train the BP, and the remaining sites were used to test the feasibility of the trained BP.

After learning process, sampling trees were mainly classified into four groups according to gradients of characteristics of trees by the trained SOM. Each group clearly showed status of sampling trees, which were dead, recovering, or intermediate status. The SOM showed its convenience to classify input vectors

and to analyze relationships among sampling trees (dead and live trees). After understanding the relationships in data sets, the BP used to predict the probability of recovering of trees from damages with a set of measurement of characteristics of corresponding trees. The model showed a high predictability ($r = 0.92$ and $r = 0.66$ for training and test data sets respectively). The prediction of recovering probability is thus a valuable tool for hazard assessment of pine trees.