

Monitoring alien plants by small UAV and TLC in Kanno river, Inbanuma catchment

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1.Introduction

In a lake of Inbanuma located in northwestern Chiba Prefecture, an alien plant of *Alternanthera philoxeroides* is introduced and breeds. This waterweed is designated as Tokutei Gairai seibutu, and not only losses biological diversity but also invades into rice field and causes the trouble in the drainage work due to being washed ashore drainage facilities in Inbanuma. Therefore Industry-academia-government-Citizen collaboration is making *Alternanthera philoxeroides* exterminated mainly Inbanuma water cycle restoration conference. However, there are few studies about *Alternanthera philoxeroides* in Inbanuma. It is urgently necessary that we know the dynamics of *Alternanthera philoxeroides* communities. In this study, we took pictures of Kanno river, Inbanuma catchment where *Alternanthera philoxeroides* is crowd from the sky at a high frequency. Then, we created high resolution ortho mosaic images that performs a detailed monitoring by using the Structure from Motion / Multi-View Stereo (SfM / MVS). We also use Time Lapse Camera (TLC) to monitor in detail.

2. Methods

We took pictures of Kanno river from the sky (5/30,6/22,7/25,8/26,9/23,10/29). We used a small UAV of enRoute Inc. ZionQC630, and the camera of RICOH Inc. GR. We used the Mission Planner of free software, and made UAV fly with the auto pilot, at 50m height from the ground. We also took pictures from the sky at 1 second intervals. We created ortho mosaic images by SfM/MVS software (Agisoft Inc. PhotoScan Professional ver1.2) based on images taken from the sky by the UAV. Then, we did interpretation of the *Alternanthera philoxeroides* communities. We used the GIS (ArcGIS 10.2), and created the polygon of *Alternanthera philoxeroides* communities that had flourished near the bank at each surveyed time. In this way, we managed the area, location, shape and the like of the each community. TLC is setting at the bridge and taking pictures of river section at 10 minutes intervals.

3. Results and Discussion

Community area in Kanno river, was 1239.8m² in May and 2080.2m² in October. During this time, the extermination of *Alternanthera philoxeroides* communities had been carried out, its area was 740m². In addition, the community that had flowed naturally was about 309.7m² totally. This indicates community practically had expanded by 2.5 times. Community flown during 8/26~9/23 was 168.2m². It is considered that heavy rain by the typhoon No. 18 during 9/6~9/10 was the cause of this outflow. The best growing community's number in the area expand was the greatest during 6/22~7/25, but the period when the each community growth is the best varied. If communities grow and community area expands, the area expand is also increased in proportion. Therefore expanding of community area was bigger late than early during observation period. What has lost the impact of this community size is the rate of expand. Also in the rate of expand, the variation was observed in the period when the rate of expand is the best, during 5/30~6/22, the number of community that was the best in the rate of expand was the greatest. In Kanno river there is variation in the community size, even the same time, and that the growth amount in proportion to the community size became big, it is easy to grow during 5/30~6/22, and gradually growth is worse become a measure of growth prediction. *Alternanthera philoxeroides* extends the roots to riverbank again after the spill. However, while the number of the 12 m² or more of the community flowing out during the observation period is

eight, there is no community to appear newly. In brief, in Kanno river, the relatively large community was difficult to fix again. On the other hand, we can check the communities of less than 2m^2 in great numbers, that is to say, the relatively small community is likely to be a community of high expansion capacity in Kanno river.

Keywords: UAV, invasive alien species, Industry-academia-government-Citizen collaboration

