Forest Boundary Mapping Using Multi-Temporal Satellite Images in North of Iran

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Introdution:
Forest planning is one of the most important steps to the better management of forest. Forest planners need several maps such as forest boundary. It is not easy to produce it with GPS or …..
Remote Sensing provide valuable data. Temporal resolution of these data makes it unique in compare to conventional data. Phonological changes of forest and non forest vegetation and availability of remote sensing data with high temporal resolution convinced the experts to use multi-temporal remote sensing images.

Present study aims to produce accurate map of forest boundary using multi -temporal satellite images

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Study area:
The study area is a part of Caspian forest. It is mixed and inhomogeneous forest and contains deciduous forest, afforested coniferous evergreen stands in the forest section, tea-citrus orchards, farms and orchards with deciduas species in the non-forest section.

Satellite images:
SPOT5-HRG scene in XS and Pan modes, Resolution: 10 & 5 m., Summer 2002
Terra-ASTER , Resolution: 15 & 30 m., Winter 2002

Image processing and enhancement:
Geometric orthorectification was performed for both SPOT and ASTER images. Suitable enhancements like NDVI, PCA, rationing, CC and data fusion were done on the both satellite images to improve the information extraction.

Classification of Images:

Four different approaches were used to delineate the forest boundary:

1- Mono-temporal classification using classical methods, PPD, MD, ML

2- Multi-temporal, multi-seasonal classification

3- Hierarchical classification

4- Hybrid digital-visual interpretation.

Ground truth map:

In order to estimate the accuracy of derived from satellite images, it is necessary to have an accurate Groud Truth. Since the most errors occur in the boundary of phenomenon, the boundary of forest and non-forest was surveyed with GPS (64.5 km) and used as ground truth map.
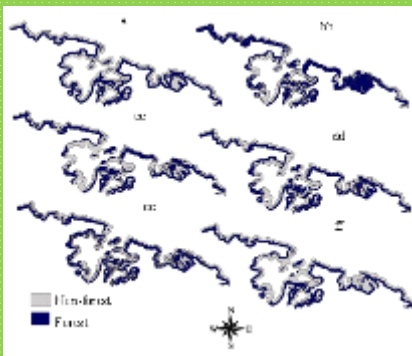

Fig. 2: Ground truth map

Result:

	Overall Accu.	Kappa Coef.
1- (b) Mono-temporal SPOT-Summer:	64%	%28
2- (c) Mono-temporal ASTER-Winter:	72%	%43
3- (d) Multi-temporal:	79%	57%
3- (e) Hierarchical SPOT & ASTER:	82%	62%
4- (f) Hybrid digital-visual:	87%	71%

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RESULT and CONCLUSION

Multi-temporal approach better than mono-temporal classification (about 10%)

Coniferous stands, gardens with leaf less vegetation in winter and shadows are main causes for errors in the multi-temporal classification.

Interaction of reflectance of needle stands with non-forest classes partly resolved in the hierarchical approach.

Hierarchical approach better than multi-temporal approach (about 5%)

Hybrid approach had presented the best results (87.3%).

Achieving a high accuracy by this approach was due to not mixing of urban and agriculture areas with forest class. Needle leaf stands were caused most errors during visual separation of classes. Interpreter cannot recognize the needle leaf stands from evergreen gardens on.

Although the ground truth was created along the boundary of classes, in which the most error may occurs, nevertheless the results of this study showed high accuracy of multi-temporal images in delineation of the forest boundary. The results of present study revealed that multi-temporal images are more suitable than the mono-temporal images for updating forest maps in such mixed and inhomogeneous covered area.

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Thank you for your attention