

рацьована "Державна програма будівництва лісових шляхів в лісфонді регіону Карпат". У цьому зв'язку передбачено створити відносно оптимальну транспортну мережу до 2020 року, із будівництвом 6828,1 км нових автодоріг з твердим покриттям круглорічної дії в розрізі: 2121,0 км – II категорії і 4707,1 км – III категорії.

На кінець завершення будівництва автомобільних шляхів в Карпатах (згідно з Державною програмою – до 2020 року) густота дорожньої мережі в регіоні повинна становити 1,06 км на 100 га, і зокрема в розрізі областей:

- Івано-Франківській області – 1,26 км на 100 га;
- Чернівецької області – 1,13 км на 100 га;
- Закарпатської області – 0,83 км на 100 га.

Реалізація даної програми дорожньої мережі в Українських Карпатах сприятиме розвитку інфраструктури в цілому і буде запорукою ефективного, невиснажливого використання природних ресурсів при інтенсивному функціонуванні туристсько-рекреаційної індустрії [5].

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POSSIBILITIES OF TRAFFIC REGULATION IN PROTECTED FOREST AREAS

The paper deals with traffic management strategy in the preserved forest area on Pokljuka highland in the centre of Triglav National Park in Slovenia. The idea of traffic management was raised by increased number of visitors especially during the high tourist season. The management includes public and forest roads with special regard to the ownership. The strategy foresees two-step management: regulation of transport - parking and soft approach – informing. The strategy proposes arrangement of parking places in the valley and on the plateau of Pokljuka as well, introducing substitutional public transport, fees, providing wider tourist offer on the plateau and providing visitors with information about natural environment, protected natural and forest areas, national park itself, code of behave in natural environment etc. The proposed traffic management strategy should be accepted by all the sectors concerned to the area studied.

Keywords: traffic, forest roads, Pokljuka highland, Triglav National park, Slovenia

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Перспективи регулювання інтенсивності руху транспорту в заповідних лісових зонах

Розглядається стратегія управління рухом транспорту в заповідній лісовій зоні – плоскогір'я Поклюка, що знаходиться в центрі Триглавського Національного парку у Словенії. Ідея управління рухом транспорту виникла у зв'язку із збільшенням кількості відвідувачів, особливо в пік туристичного сезону. Стратегія управління здійснюється за двома напрямками: регулювання паркування транспорту і забезпечення інформацією туристів. Пропонується: облаштовувати місця для паркування як в низині, так і на плато Поклюка; залучати альтернативний громадський транспорт; збирати плату за в'їзд, забезпечувати туристів широким спектром послуг та інформацією про заповідні лісові зони, Національний парк та про правила поведінки на природі.

Ключові слова: інтенсивність руху, лісові дороги, плоскогір'я Поклюка, національний парк Триглав, Словенія.

1. Introduction and research problem

In recent years the Rousseau's saying "Back to the Nature" became actual due to change of lifestyle not only in developed countries. Popularization of free-time activities in nature (mostly in forest) raised larger number of visitors also in the regions of protected nature. In the case of Slovenia the only national park, Triglav National Park, is over visited especially during the high summer season. Development of mass winter tourism in the Alps since 1960 raised the question also in Slovenia: "How to involve mountain areas into tourism?". It seems that locations between 1.200 m and 1.500 m. a.s.l. are the most suitable for alpine tourist development where climate conditions enable as well winter and summer season attractive [7].

Beside mentioned several different interests, tradition, intentions, visions of development meet at this picturesque area. Traditionally forestry and agriculture are permanently present in the Alpine region beside the protected area Triglav National Park. Inside the National Park on the plateau of Pokljuka is located Military Training Centre with all facilities for biathlon competitions. There is also interest from the land owners – forest and pasture owners, Association of mountaineers etc.

It is obviously that area of protected nature is overcrowded during the high season and regulation of traffic is necessary. It is not only a problem of parking; it is a problem of noise, disturbance in natural environment. The role of the foresters is to propose such traffic regulation which would involve interests of visitors and protected nature.

2. Working methods and research object

Complex problem as is the case of area of protected nature requires complex working methods. Studying of References is just a beginning followed by field work using methods of observing and questionaring [3].

The research object is a plateau of Pokljuka which is a part of Triglav National Park. Areas and roads (public and forest roads) with the most intensive traffic were taken into consideration. The study area of 6.703 ha is mostly covered by mountain forest with Norway spruce as a dominant tree species in associations Abieti – Fagetum prealpinum and Piceetum subalpinum. The average attitude of Pokljuka is between 1.200 and 1.700 m a.s.l.



Figure 1. Location of the Triglav National Park (www.sigov.si/tnp)

Firstly we established the capacity of existing parking spaces on the plateau of Pokljuka and located the most intensively visited areas. These areas were lately recognized as suitable or non suitable to be visited. Finally we determined the future development strategy for all suitable locations.



Figure 2. The plateau of Pokljuka as an area studied within the Triglav National Park (www.sigov.si/tnp)

Existing parking spaces had various shapes so it took some time to survey all of them correctly. Several smaller existing parking spaces were later recognized as unsuitable because of their location too close to the trees, places with possible

erosion etc. We used Technical guidelines [2] for projecting of urban traffic areas to establish the real capacity of parking spaces in the plateau of Pokljuka.

3. Results

3.1. State of the Art

Visitors of Pokljuka are:

- stationary visitors from cottages, inns, hotel on the plateau,
- owners of summer cottages (only on the mountain of Goreljek more than 120 cottages),
- daily visitors: coming from tourist centers like Bled and Bohinj and other parts of Slovenia and neighboring countries,
- land owners.

The most important and frequent activities are:

- hiking and picking up mushrooms, blueberries etc.,
- mountaineering: plateau is an ideal starting point for mountaineering to Triglav group mountains,
- mountain biking: for an average biker the plateau with several roads is suitable because of gentle road slopes and, mainly on forest roads, low traffic,
- cross country skiing: suitable for winter sports because of the natural shape of plateau, numerous unplugged forest roads and paths,
- free skiing: more and more popular in recent years.

As an impression of number of visitors during the summer season: in summer 1997 [9] on an average working day 1.850 persons visited Pokljuka, 3.880 on an average weekend day and more than 182.000 in the whole season. Problem should be concerned thoroughly because we deal with traffic in protected natural environment.

On the basis of answers of 21 different local communities, associations and services concerned about Pokljuka and Triglav National Park we conclude that 90 % of concerned believe that the situation on Pokljuka is problematic. According to their answers the responsibility is to be given to Triglav National Park Organization (100 %), local community (infrastructure, 90 %), state (Ministry of Transport and Communications, Ministry of Defense, 60 %), Slovenian Forest Service (forest roads, 60 %) etc.

One of the questions was also what professions (professionals) should be involved into the working group in order to prepare the proposal of management of the plateau. Answers focused into forester, biologist, lawyer, economist etc. Therefore foresters are professionals who are supposed to be the most qualified to prepare i.e. guidelines for traffic regulation.

3.2. Proposal of Traffic Regulation

Every traffic regulation should comprise:

- determination of preferential directions and traffic management,
- limitations of road usage according to the type of traffic,
- speed limits and measures in order to slow down the traffic,
- regulation of parked vehicles,
- determination of low-speed zones and pedestrian zones,
- determination of other commitments.

There is no transit traffic on Pokljuka so parking places are necessary. Traffic should be directed toward several organized parking places away of zones of quietness. With the first phase of regulation we determine existing locations (con-

sidering the capacity and proximity of locations with higher protection) as suitable or non suitable for parking. If location is suitable it should be equipped with information tables (maps, current location, free-to-use and closed roads, places of natural heritage, important objects etc).

In the second phase of traffic regulation on Pokljuka we consider possibility of larger central parking on the plateau and in the valley as well with implementation of public transport system from valley to the plateau. Here are two possibilities:

- to enable access to the plateau until the parking are occupied and later using the parking spaces in the valley,
- parking only in the valley and use of public transport system from valley to the plateau.

The basic purpose of the strategy is to convince as much as possible visitors to leave their cars in the valley.

Another point of view is time aspect. The traffic limitations could be:

- permanent,
- temporary during the summer and winter season,
- temporary during the sport events.

Introducing of high parking fee on the plateau and free parking in the valley with free public transport (included in entrance fee) might bring adequate results in high season. Permanent traffic limitations might be non productive because traffic out of the season is very limited and not problematic to the environment.

We should also consider road barriers what means that roads are used only for bikes and pedestrians. Positive aspects of barriers are:

- effective protection of nature and zones of quietness,
- enabled emphasized forest functions,
- safely carrying out of forest operations.



Figure 3. Road barrier is an effective means of traffic regulation but should be implemented thoroughly

Beside positive road barriers bring also negative effects. The measure itself should be introduced thoroughly and limited only to the high season.

The last step in traffic regulation is "soft approach". The strategy of traffic regulation foresees soft approach where restrictive measures are not suitable. The purpose is to inform and to advice visitors especially on the locations of private property. Use of wooden signs or other natural material with symbols of expected manners is required. Soft approach is an alternative for road barriers during the low season when the barriers are not necessary.



Figure 4. Symbols of expected manners in natural environment

4. Discussion

The proposed strategy is based on the cognition that investing to the areas of protected nature – in our case traffic regulation – is an investment and not a consumption. Request for natural environment and spending spare time in pure nature will increase. The intensity of growth and locations are hardly to be predicted; we expect increased visit to the most popular and attractive locations. Traffic and environmental problems of over-visited of the Pokljuka plateau are limited to the high season. We are convinced that informing of visitors plays the crucial role and should be involved to the strategy already at the very beginning. Traffic regulation brings also some other information: distribution of visitors during the season and migration during the working days and weekend days, information on expectations of visitors, social distribution of visitors etc. Information used in this paper are based on the estimation and traffic counting on the rush days. Another problem is related to forest roads: basically forest roads are opened for tourist traffic beside forest traffic. The problem is how to ensure higher standard of transportability (better maintenance, traffic signs etc.) which is necessary for safe traffic and it's not necessary for forest management itself. In future years we may expect even increased number of visitors and disturbance in natural environment. The index of motorization (relation between population and number of personal cars) shows trend of its intensive decreasing which means more vehicles and visitors not only in centers but also in regions like Pokljuka [5].

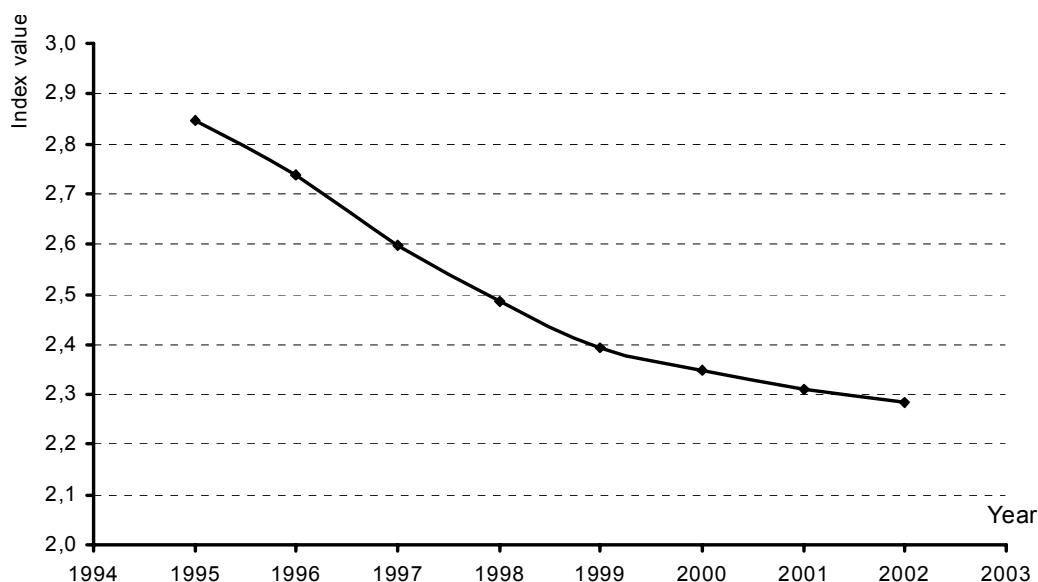


Figure 5. Trend of index of motorization in Slovenia

The amount of fund for maintenance of forest roads is insufficient although the state budget contributes 35 % for maintenance of forest roads. It seems that introduction of i.e. toll, entrance ticket, tourist tax, environmental tax etc. is necessary. We shall all be aware that also pure nature and its protection are simply not for free.

5. Summary

The basic aim of the study was raised by the crossing of different interests in the natural environment and intensive tourist visit. The case study was performed at Pokljuka plateau in the Triglav National Park in Slovenia.

On the basis of the actual situation, evaluation of landscape and taking into account the guidelines of several institutions concerned about the Triglav National Park we suggest two-step strategy of traffic regulation. The strategy comprises restoring of parking spaces, road barriers (first step) and soft approach in terms of informing and advising visitors (second step). In the first step the estimation of suitability of landscape, long-term development of road facilities with additional informing are the crucial elements. The second step means to reach the final situation in carrying out the strategy as a whole. The whole system is presented by organized central parking spaces in the valley and on the plateau, organized substitutional public transport to and on the plateau, system of informing and advising and propagating of alternative forms of comprehension of nature (hiking, cycling, horse riding etc.). The general approach in solving traffic problems in natural environment should be to reach the consensus among the institutions and associations interested in. Working group of different experts seems to be the most effective way to find the optimal way how to use and manage natural environment in close-to-nature way.

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ОБҐРУНТУВАННЯ СПОСОБУ ТРАНСПОРТНОГО ОСВОЄННЯ ГІРСЬКОГО ЛІСОВОГО МАСИВУ

Наведено концептуальну модель транспортного освоєння лісового масиву, яка окреслює лісозаготівельну стратегію та дає змогу обґрунтувати технологію лісотранспорту на основі порівняння питомих вартісних показників будівництва лісових доріг та заготівлі деревини. Модель реалізовано за блоковим принципом в середовищі Microsoft EXCEL. З використанням розробленої моделі виконане порівняння транспортного освоєння гірських лісових масивів в Українських Карпатах на базі колісного лісопромислового трактора та мобільного лінвового обладнання.

Ключові слова: лісотранспортне планування, густота дорожньої мережі, вартість лісозаготівлі і дорожнього будівництва.

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Rationalization of timber transport technologies under mountainous conditions

The presents a conceptual model of timber extraction, which outlines the harvest strategy and permits a justification of the technology and the technical means for timber transport by comparing of the allocated unit costs of timber harvesting and road construction. A model is presented on the sectional principle in the software Microsoft EXCEL. The developed model allowed for a comparative analysis of different transport technologies under mountainous conditions in the Ukrainian Carpathians.

Keywords: forest transportation planning, density of the road network, cost of the timber harvesting and road construction.

Вступ

Одна із найважливіших проблем лісотransпортного планування полягає в прийнятті рішення щодо можливості застосування наземної, лінвової чи повітряної технології транспортування, що в свою чергу пов'язано з оцінкою транспортної доступності лісового масиву.

Майже всі наукові дослідження, що стосуються моделювання лісотransпортної мережі, оцінки та оптимізації її густоти виконано для рівнинних

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