Socio-environmental aspects of the development of mineral raw material resources industry in the border regions of the East of the Russian Federation

I P Glazyrina¹,², L M Faleychik¹ and I A Zabelina¹

¹Institute of Natural Resources, Ecology and Cryology SB RAS, Russia, Chita
²Transbaikal State University, Russia, Chita

E-mail: iglazyrina@bk.ru, lfaleychik@bk.ru, i_zabelina@mail.ru

Abstract. The paper presents calculations demonstrating the role of the mineral resource complex from a socio-ecological point of view. The activities of the industry should ensure the development of high-quality social infrastructure and a fairly high standard of living of the local population, including the quality of the environment. This is especially important because enterprises tend to be located in remote areas with not the most favorable climatic conditions. The paper shows the contribution of the raw mineral resource complex on the regional income tax. To compare the environmental impact of the industry with its contribution to the economic growth, an eco-intensity indicator is used. There is a significant differentiation between the Eastern border regions of Russia in terms of socio-environmental dynamics in the field of mining. The most successful is the development of the mineral sector of the Irkutsk region: there is a significant increase in the wage fund, and the improvement of environmental characteristics of emissions into the air. The calculations revealed an unfavorable situation in Primorye Territory. With the reduction of the wage fund formed in the mineral sector, there was an increase in eco-intensity by more than one and a half times.

1. Introduction
Border regions of Siberia and the Far East still retain their natural resource specialization, where mining plays the central role [1]. Despite the fact that the reduction of the share of the raw material sector in the country's economy remains a strategic task of state economic policy, for the Eastern regions, it is unlikely to be resolved in the medium term. Therefore, it is necessary to create priorities for the development of modern industries with high rates of economic efficiency and environmental safety. The activities of these industries should ensure the development of high-quality social infrastructure and a fairly high standard of living of the local population, including environmental conditions. This is especially important because enterprises tend to be located in remote areas with not the most favorable climatic conditions. It is well known that high incomes of mining companies and salaries of top management often coexist with very low incomes of numerous ordinary personnel. Evaluation of some of these trends is the subject of this work. The border position of the regions can play a significant role, since a significant part of the products of the raw minerals is exported. However, the boundaries have certain "barrier" properties, and this is often a significant factor in the development processes[3].
2. Data and methods
The information base of this study is the official statistical information from the databases of the Federal state statistics service and the Federal Tax Service of Russia for the 2011-2017 time period, analytical information posted on official Internet resources and professional websites.

The research methodology is based on the theories of spatial and regional economics. Spatial analysis of the distributions of the studied indicators by regions of the Russian Federation and interregional comparisons were performed in the geographic information environment of ArcGIS. Interregional comparisons were made at comparable prices, taking into account the regional consumer price indices (CPI), the base year is 2011.

3. Results and discussion
The contribution of the raw mineral resource complex (MRC) to the gross regional product (GRP) of the Russian regions in 2017 is shown in figure 1. On the map purple outline highlighted the border regions of the East of the Russian Federation, to which special attention is paid.

![Figure 1](image_url)

**Figure 1.** Contribution of the mineral resource complex to the gross domestic product of the Russian regions in 2017, percentage of total.

Figure 2 shows that in most Eastern border regions the share of mineral extraction in GRP increased from 2011 to 2017. Thus, raw materials specialization in the East of the country remains.

One of the most important indicators of the impact on the standard of living is the dynamics of the volume of the wage fund, which is generated in the region during the development of the industry. For its assessment, we used the data of the Federal Tax Service on the payment of personal income tax (PIT). However, in the context of assessing living standards, it is important to take into account changes in the cost of living due to inflation. The data were therefore adjusted to reflect consumer price indices (CPI) for each region. The results are shown in figure 3. These data suggest that in most of the regions under consideration, the wage fund created by the industry has increased, in the Irkutsk region more than in one and a half times.

The role of fuel and energy minerals and all others in solving the problem of replenishment of budgets varies. The results of the corresponding calculations are shown on figure 4.
Figure 2. The contribution of "Extraction of minerals" economic activity in the GRP, percentage of total.

Figure 3. The increase in income tax from "Extraction of minerals" economic activity in 2017 compared to 2011 (adjusted to the CPI).

Figure 4. Dynamics of personal income tax revenues for 2011-2017, mln. RUB., in 2011 prices (a) – from the "Extraction of fuel and energy minerals" economic activity, (b) – from the "Mining and quarrying economic activities, except for fuel and energy".
Figure 5 shows how the share of personal income tax from mining in the total volume of regional personal income tax has changed from 2011 to 2017. This can serve as a characteristic of the importance of the industry in terms of the regional labor market as a whole.

However, the impact of industry development on the individual well-being of employees reflects the dynamics of average wages. It can be quantified by the per capita personal income tax, which is also calculated taking into account the CPI and presented in figure 6. It can be concluded that real wages (i.e. nominal wages adjusted for the CPI) have increased since 2011 in most regions, even in the Trans-Baikal Territory, where its total fund has decreased in comparison to 2011 (figure 3).
Data on the number of employees in the field of mining in dynamics are presented in figure 7. In most regions, with the exception of the Irkutsk region and the Jewish Autonomous region, the number of jobs has decreased. On the one hand, taking into account the growth of the contribution to the GRP of the regions, this indicates an increase in labor productivity. On the other hand, it reflects the "shrinkage" of the industrial labor market.

Figure 7. Average number of people employed at extraction of minerals, thousand people.

An important element of the quality of life is the state of the environment. Environmental problems of mineral regions are associated to a greater extent with harmful emissions into the atmosphere. This is the subject of constant media attention. In some cases special resolutions of the government of the Russian Federation are adopted. To compare the environmental impact of the industry with its contribution to economic growth, an eco-intensity indicator is used [6]. It represents the ratio of the total pollution from industry enterprises to their total gross value added per year. Reduced eco-intensity means that enterprises conduct environmental activities more efficiently. In table 1 the current trends since 2005 are presented.

Table 1. Eco-intensity of air pollutant emissions from stationary sources for the "Mining and quarrying" economic activity in regions of Far East and South of Siberia.

| Regions                      | Eco-intensity of air pollutant emissions from stationary sources (t / million rubles) | Change in eco-intensity of emissions (%) |
|------------------------------|----------------------------------------------------------------------------------------|------------------------------------------|
|                              | 2005          | 2009          | 2016          | 2005-2016 | 2009-2016 |                           |
| Republic of Buryatia         | 1.31          | 1.33          | 1.05          | -19.4     | -21.0     |                           |
| Trans-Baikal Territory       | 6.61          | 4.25          | 0.87          | -86.8     | -79.4     |                           |
| Irkutsk Region               | 2.93          | 1.22          | 0.93          | -68.4     | -24.2     |                           |
| Primorye Territory           | 2.61          | 2.20          | 3.45          | 31.9      | 56.7      |                           |
| Khabarovsk Territory         | 0.88          | 0.55          | 0.63          | -29.3     | 13.5      |                           |
| Amur Region                  | 1.20          | 0.79          | 0.74          | -38.3     | -6.0      |                           |
| Jewish Autonomous Region     | 2.82          | 7.76          | 7.95          | 182.2     | 2.5       |                           |
| Russia as a whole            | 2.66          | 2.61          | 1.86          | -30.3     | -29.0     |                           |

Figure 8 shows the dynamics of changes in eco-intensity in extraction of minerals (emissions to the atmosphere) for all regions of Russia. It should be noted that, unlike most areas of the European part of the country, in the Baikal region it is quite positive. However, in the border regions of the Far East
(with the exception of the Amur region), there is an increase in eco-intensity. The situation is particularly unfavorable in Primorye Territory, where this figure is almost twice as high than the national average.

![Figure 8](image)

**Figure 8.** Change in eco-intensity of air pollutant emissions from stationary sources for the "Mining and quarrying" economic activity in Russian regions from 2009 to 2016, %

4. Conclusion

The results suggest that there is a significant differentiation between the Eastern border regions of Russia in terms of socio-environmental dynamics in the field of mining. In most regions, the industry ensured the growth of the wage fund formed in it for the period from 2011 to 2017. External shocks particularly, the fall of the ruble during this period, in this case, played a positive role, since a significant part of the products of raw minerals is exported. The reduction of eco-intensity should be considered a positive aspect. This suggests that in most regions there is an environmental modernization of the industry. The most successful in this context is the development of the mineral sector of the Irkutsk region: there is a significant increase in the wage fund, and the improvement of environmental characteristics of emissions into the air.

At the same time, calculations revealed an unfavorable situation in Primorye Territory. With the reduction of the wage fund formed in the mineral sector, there was an increase in eco-intensity by more than one and a half times. This suggests that the industry in this region requires increased attention from the government and some urgent measures to reduce the negative impact on the environment. The same can be attributed to the Jewish Autonomous Region. The level of eco-intensity of air pollution in 2016 there is more than 4 times higher than the national average.

One more thing should be noted. Mineral sectors in these regions are classified as basic industries that have an important role to play in socio-economic processes [9]. One of the main problems here is a steady decline in the population, including migration outflow [9]. Therefore, improving the level and quality of life remains the most important task of public policy. The results obtained will allow to define a roadmap aimed at its solution in mineral and raw materials sectors.

Further research involves the study of the eco-intensity of other types of negative anthropogenic impact, both in the mineral sector and in other basic industries in the border regions in the East of the country.
Acknowledgments
The work was carried out in accordance with the State task for project XI.174.1.8. of Basic research programs of SB RAS. Assessment of the dynamics of the amount of payroll generated in the mineral sector made in the framework of the project RFBR № 19-010-00485.

References
[1] Antonova N E and Lomakina N V 2018 Natural resource-based industries of the Far East: New Drivers of Development. Economic and Social Changes: Facts, Trends, Forecast 11(1) 43-56
[2] Lomakina N V 2014 Industrial development of the Far East Russia and Northeast of China: the purposes, results and opportunities for cooperation Eco 6(480) 25–39
[3] Kolosov V A 2018 Paradoxes of globalization and increasing barrier functions of borders in the contemporary world Regional Studies 3(61) 9-18
[4] Russian Borderland: Challenges of Neighbourhood 2018 ed V A Kolosov (Moscow: IP Matushkin I I) p 562
[5] Newman D 2011 Contemporary research agendas in border studies: an overview Ashgate Research Companion to Border Studies ed D Wastl-Water (Burlington: Ashgate Publishing Company) pp 33–47
[6] Quality of Growth Indicators for Regional Economies 2005 ed I P Glazyrina and I V Potravny (Moscow: NIA–Priroda) p 306
[7] de Haan M 2004 Accounting for Goods and For Bads: Measuring Environmental Pressure in a National Accounts Framework (Voorburg: M de Haan) p 216
[8] Zabelina I A 2019 Decoupling in environmental and economic development of regions-participants of cross-border cooperation Economic and Social Changes: Facts, Trends, Forecast 12(1) 241-55
[9] Lomakina N V 2018 Reform transformations and their results in the mineral sector of the Far East Spatial Economics 1 59–82
[10] Glazyrina I P and Faleychik L M 2016 Russia’s Eastern Borderlands: The Problem of Supplying Human Capital Problems of Economic Transition 58(7-9) 697-710
[11] Shvorina K V and Faleychik L M 2018 Main directions of migration mobility in the Siberian and Far Eastern federal districts Economy of Region 14(2) 485-501