

第十二讲 如何写结论

结论(conclusion)又称为结束语、结语,是在尊重客观事实的基础上,体现作者更深层次的认识,并对整篇论文进行的全局性总结。

本讲提出了一般科学论文结论写作的基本要求,梳理了不同类型期刊论文结论的写作类型及基本内容,结合案例分析对比了不同结论写作的风格,以期帮助初学者更好完成这一正文写作最后的“画龙点睛”之笔。

第一节 基本要求

结论是对整篇论文的全局性总结,是基于研究所有材料的系统整理、归纳演绎以及提炼,得到的关于对研究科学问题及事物本质与发展规律的新的观点与认识。

与论文正文其它部分相比,结论部分所占篇幅较小,但是整篇论文的精华。一个表达准确、简明扼要的结论,既反映了作者严密的逻辑思维能力和高超的概括能力,也能实现科学论文传播过程中的信息增效作用,帮助编辑、审稿人以及广大读者了解研究内容的价值。

一般的,科学论文写作中,结论写作需遵循以下基本要求:

1. 总结概括研究重点

结论部分作者需对整个研究进行总结概括,阐述内容需突出论文各部分的重点内容,如引言部分提出关于解决科学问题的重要性,研究方法有何创新性及相关模型有何优越性、研究结果有何重大发现(罗列必要的重要数据)等。可以说,凡是与论文主题和创新最为相关的内容,都是结论部分写作总结概括的重点。

2. 判断推理客观

结论必须基于事实(如实验及观测结果等)之后,做出的客观判断与推理。不作无根据、不合逻辑的推理。要恰如其分地评价研究结果,不可夸大其词、自鸣得意;同时,也无需过度谦虚、谨小慎微。结论中要谨慎地进行自我评价,如使用本研究“具有国际先进水平”、“属国内首创”、“填补了国内空白”等语句,要做到结合客观实际。此外,避免采用假设来证明假设,用未知来说明未知,以此循环推论。

3. 逻辑内容及语言表述严谨

结论部分的写作,需要做到逻辑严谨、内容严谨、表述严谨。(1)逻辑严谨体现在,结论部分写作内容必须与全文其它部分内容相互呼应、观点一致。如在引言中,关于关键科学问题的表述,若在结论中再次提到,那么表述应该是一致的,同时也应看到研究已经对这一关键科学问题进行了清晰地回答。再如引言部分中指出本研究是某领域的空白、研究的难点,那么,结论中需要看到是如何通过研究对所提出的空白和难点进行了弥补和解决,强调要有始有终。(2)内容严谨体现在,结论对尚不能完全肯定的内容,论述上要留有余地,不能轻率地否定或批判已有研究成果,更不能为了凸显自身研究的重要性和价值而刻意贬低他人。(3)语言表述严

谨,即措辞严谨,体现在避免使用模棱两可或抽象笼统的语句,如使用“大概”、“也许”、“可能”等词语,避免出现在关键性的论点之中。

4. 避免生硬地重复

结论对研究内容的总结概括,并不意味着对相关内容进行生搬硬抄、重复一模一样的话,而是在尊重客观事实、不违原意的前提下,进行富有创新性、拓展性的表述。如根据已有研究发现,进行合理推论、延展,升华主旨内涵等。

结论的写作与摘要关联性最强,也是初学者在写作过程中,最容易混淆而导致重复的一个常见问题。但是,两者是不同性质的部分,内容上是不应该重复的。从功能上看,摘要是读者快速了解全文的一个窗口,而结论旨在全面扼要地回答论文引言中所提出的关键科学问题,从而使得论文整体构成“提出问题-分析问题-回答问题”的一个完整逻辑。例如,当提出关键科学问题是“全球变暖会导致火灾增加吗?”,结论可能的回答应该是“全球变暖只是火灾频率增加的一个原因”。这时,相对于其它内容而言,因为不是交代重点,可以不写。但是对于摘要而言,其它内容则是必不可少的、要写的一环。

5. 内容与形式力求简洁明了

在满足上述要求的前提下,结论的写作形式与内容还需做到尽可能的简洁明了,使得读者容易抓住关键性结论和研究的主要贡献。

如果研究结果中的发现内容众多,那么写作时,要有选择性地为读者呈现出其中最为关键性的结果和重大发现,重在突出主要结论和基本观点。

如果实在是难以取舍,或者希望能够做到力求全面,则可采取分层次、分段落的形式呈现,至少要在信息表达的形式上做到简洁明了。

第二节 类型与内容

一、写作类型

结论的写作类型是指,论文内容是否需要包含结论,以及结论的设计应该属于哪一部分。下表列举了一些不同期刊的要求和论文案例,以供初学者对结论写作有一个大致的了解。

表 12-1 不同期刊结论部分写作要求和论文案例

期刊	IF 2023	要求	论文案例	结论类型
Nature Communications	16.6	无	<i>Mapping global urban land for the 21st century with data-driven simulations and Shared Socioeconomic Pathways</i> ^①	Discussion
Science Advances	13.6	无	<i>Water scaling of ecosystem carbon cycle feedback to climate warming</i> ^②	Results and Discussion

① Gao, J., O'Neill, B. C., 2020. Mapping global urban land for the 21st century with data-driven simulations and Shared Socioeconomic Pathways. Nat Commun 11, 2302. <http://doi.org/10.1038/s41467-020-15788-7>.

② Quan, Q., Tian, D., Luo, Y., Zhang, F., Crowther, T., Zhu, K., Chen, H., Zhou, Q., Niu, S., 2019. Water scaling of ecosystem carbon cycle feedback to climate warming. Science Advances. <http://doi.org/10.1126/sciadv.aav1131>.

续表

期刊	IF 2023	要求	论文案例	结论类型
Journal of Cleaner Production	11.1	The main conclusions of the study may be presented in a short Conclusions section, which may stand alone or form a subsection of a Discussion or Results and Discussion section.	Using stepping-stone theory to evaluate the maintenance of landscape connectivity under China's ecological control line policy ^①	Conclusions
			Stakeholder games in the evolution and development of green buildings in China: Government-led perspective ^②	Conclusions and Suggestion
Landscape and Urban Planning	9.1		Within-city spatial and temporal heterogeneity of air temperature and its relationship with land surface temperature ^③	Conclusion
			An evaluation of species distribution models to estimate tree diversity at genus level in a heterogeneous urban-rural landscape ^④	Discussion and Conclusions
Journal of Environmental Management	8.7		Evaluation of water conservation function of Danjiang River Basin in Qinling Mountains, China based on InVEST model ^⑤	Conclusion
Land Use Policy	7.1		How feasible is regional integration for reconciling land use conflicts across the urban—rural interface? Evidence from Beijing—Tianjin—Hebei metropolitan region in China ^⑥	Conclusions

① Luo, Y., Wu, J., Wang, X., Peng, J., 2021. Using stepping-stone theory to evaluate the maintenance of landscape connectivity under China's ecological control line policy. *Journal of Cleaner Production* 296. <http://doi.org/10.1016/j.jclepro.2021.126356>.

② Feng, Q., Chen, H., Shi, X., Wei, J., 2020. Stakeholder games in the evolution and development of green buildings in China: Government-led perspective. *Journal of Cleaner Production* 275. <http://doi.org/10.1016/j.jclepro.2020.122895>.

③ Cao, J., Zhou, W., Zheng, Z., Ren, T., Wang, W., 2021. Within-city spatial and temporal heterogeneity of air temperature and its relationship with land surface temperature. *Landscape and Urban Planning* 206. <http://doi.org/10.1016/j.landurbplan.2020.103979>.

④ Stas, M., Aerts, R., Hendrickx, M., Dendoncker, N., Dujardin, S., Linard, C., Nawrot, T., Van Nieuwenhuyse, A., Aerts, J.-M., Van Orshoven, J., Somers, B., 2020. An evaluation of species distribution models to estimate tree diversity at genus level in a heterogeneous urban-rural landscape. *Landscape and Urban Planning* 198. <http://doi.org/10.1016/j.landurbplan.2020.103770>.

⑤ Li, M., Liang, D., Xia, J., Song, J., Cheng, D., Wu, J., Cao, Y., Sun, H., Li, Q., 2021. Evaluation of water conservation function of Danjiang River Basin in Qinling Mountains, China based on InVEST model. *J Environ Manage* 286, 112212. <http://doi.org/10.1016/j.jenvman.2021.112212>.

⑥ Ma, W., Jiang, G., Chen, Y., Qu, Y., Zhou, T., Li, W., 2020. How feasible is regional integration for reconciling land use conflicts across the urban-rural interface? Evidence from Beijing-Tianjin-Hebei metropolitan region in China. *Land Use Policy* 92. <http://doi.org/10.1016/j.landusepol.2019.104433>.

续表

期刊	IF 2023	要求	论文案例	结论类型
Ecological Indicators	6.9	The main conclusions of the study may be presented in a short Conclusions section, which may stand alone or form a subsection of a Discussion or Results and Discussion section.	Ecological environment assessment for Greater Mekong Subregion based on Pressure-State-Response framework by remote sensing ^①	Results and Conclusion
			Evaluation of ecosystem services value and its implications for policy making in China-A case study of Fujian province ^②	Conclusions and Discussions
Urban Forestry & Urban Greening	6.4		The influences of habitat proportion and patch-level structural factors in the spatial habitat importance ranking for connectivity and implications for habitat conservation ^③	Conclusion

根据上表可知,结论的写作有多种类型,整体设计也比较灵活。除 Nature、Science 等期刊无结论写作要求外,结论既可以是单独的一节,也可以与讨论、结果等合并撰写,有时候还会重点强调建议与启示。总体上,结论写作有以下几种基本写作类型:

1. 独立结论(Conclusions)

结论通常作为一个独立的部分呈现给读者,位于论文最后一节,是一种最常见的写作类型。这种类型的论文,通常主线清晰,提出的关键科学问题以及研究目标明确,从“提出问题”到“分析问题”再到“回答问题”的逻辑架构明显,所得结论(包括观点、主张、建议等)也比较聚焦。

2. 讨论与结论(Discussion and Conclusion)

这也是一种很常见的写作类型。很多作者通常会根据研究内容和写作需要,采取这种类型。其写作特点是,讨论与结论内容相互交织、融合。不过,其另外一个特征也很明显,就是内容上通常比较分散、冗长。不过,通过合理有序的组织,还是可以有效突出关键性论点,呈现出较为系统全面的解释说明。

3. 结果与结论(Results and Conclusion)

此种类型相比前两种类型而言,较为少见。其特点与“结论与讨论”写作类型相似。该类型中,研究结果即是结论的倾向性明显,两者关系密切,主要表现为结果众多,且涉及多个结论。通常,这种类型有时容易出现基于结果部分进行推导结论和总结的必要性不足等问题,初学者在使用过程中,需要注意。

① Wu, J., Wang, X., Zhong, B., Yang, A., Jue, K., Wu, J., Zhang, L., Xu, W., Wu, S., Zhang, N., Liu, Q., 2020. Ecological environment assessment for Greater Mekong Subregion based on Pressure-State-Response framework by remote sensing. Ecological Indicators 117. <http://doi.org/10.1016/j.ecolind.2020.106521>.

② Su, K., Wei, D.-z., Lin, W.-x., 2020. Evaluation of ecosystem services value and its implications for policy making in China-A case study of Fujian province. Ecological Indicators 108. <http://doi.org/10.1016/j.ecolind.2019.105752>.

③ Qi, K., Fan, Z., Xie, Y., 2021. The influences of habitat proportion and patch-level structural factors in the spatial habitat importance ranking for connectivity and implications for habitat conservation. Urban Forestry & Urban Greening 64. <http://doi.org/10.1016/j.ufug.2021.127239>.

4. 无结论

此类型中,论文重在揭示客观事实、科学规律等。此时研究重点在于得到什么结果及其准确性和科学性上。一般不要求在其基础上进行推论和总结。

二、主要内容

以下通过几则“独立结论(Conclusion)”写作方法的具体案例,深入剖析科学论文结论部分写作的一般内容。希望通过案例分析,对初学者在结论部分撰写过程中有所帮助:

例 1^①:

原文	要点分析
	该文结论部分是单独的一节,并仅有一段。内容描述全面系统,逻辑清晰,由研究背景、研究方法、研究结果、主要结论和研究价值 5 个方面构成。
① <i>Given the increasing fragmentation of urban ecological land, maintaining landscape connectivity has become an important issue in landscape ecology.</i> ② <i>In China, the government has established ecological control lines (ECLs) to protect the connectivity between important ecological patches, and assessing the effectiveness of this policy in managing landscape fragmentation has become important.</i>	句①阐述背景,即城市生态用地破碎化的增加,引出保持景观连通性是研究领域的重要话题;句②过渡至中国背景,强调中国政府实施“生态红线政策”以保护生态斑块间连通性的背景,进而引出评估实施的有效性具有的必要性和重要研究意义。
③ <i>Using circuit and stepping-stone theories, the authors evaluated the protection afforded by ECL designation to ecological flow, and identified key stepping stones that urgently needed to be protected.</i>	句③阐述了研究方法,采用电路理论与垫脚石理论,并指出用于识别需要保护的重要垫脚石的研究目的。
④ <i>The results showed that there were 1488 ecological stepping stones in the study area, with an average area of 0.124km² and a total area of 185.2km².</i>	句④指出研究结果,通过定量描述给出识别到的生态斑块数量和面积。
⑤ <i>Looking at these hotspots and the ECL protection area, we found five unprotected hotspots whose loss would threaten ecological source connectivity.</i> ⑥ <i>Altogether, there were 34 key stepping stones in Shenzhen that were not effectively protected by the ECL and needed to be included in its protection range.</i>	句⑤~⑥是基于结果的推论,上升到基本结论,即得出“存在保护不足”的论点。
⑦ <i>Our study combined stepping-stone theory with circuit theory to identify areas where ECL connectivity protection was weak, thus making a significant contribution to improving the effectiveness of ECL Policy.</i>	句⑦总结了研究价值,说明研究结果有益于显著提升政策的有效性。

① Luo, Y., J. Wu, X. Wang, and J. Peng. 2021. Using stepping-stone theory to evaluate the maintenance of landscape connectivity under China's ecological control line policy. *Journal of Cleaner Production* 296:126356.

例 2^①：

原文	要点分析
	该文结论部分是独立的一节，包括 2 段，由研究背景、研究结果、结论、价值以及未来研究展望 5 方面构成。
Paragphy 1 ：① <i>The construction of ecological network can improve the landscape connectivity of highly urbanized area and the protection of biodiversity.</i>	段 1 句①阐述背景，即构建生态网络可以提升高度城市化地区景观连通性和物种多样性保护。
② <i>In this study, the MSPA method was used to identify the core area that are important for maintaining regional landscape connectivity, and the ecological sources were identified based on the level of landscape connectivity.</i> ③ <i>Based on the ecosystem service value, the resistance surface was built and modified by ecological sensitivity and landscape connectivity.</i> ④ <i>Ecological network was constructed using MCR model and optimized by Similarity Search and Cost Connectivity module.</i>	句②~④描述研究方法。
⑤ <i>The results indicate that: (1) Twenty-five ecological sources were identified and the total area of which is 453.29km², accounting for 22.70% of the study area. Ecological sources are mainly distributed in the southeast and west, where forest land and water land are the main land use type. There were 29 ecological corridors with a total length of 305.12km, of which there were 5 corridors with higher risk. The number of ecological nodes was 36. For the optimized ecological network, 10 new ecological sources with an area of 22.51km² were added, and 46 ecological corridors with a length of 421.37km and 59 ecological nodes were identified. (2) The combination of morphological spatial pattern analysis (MSPA) and landscape connectivity analysis to identify ecological sources takes both the function of ecosystem and the function of patches in the landscape into consideration. (3) The construction of a comprehensive ecological resistance surface took ecosystem services, ecological sensitivity and landscape connectivity into consideration, which emphasizes that ecological resistance is influenced by nature, human activity and connectivity of landscape. The comprehensive ecological resistance surface could simulate the actual ecological resistance well and provide advice for the construction and optimization of ecological network in highly urbanized regions.</i>	句⑤至段尾为研究结果，其中(1)通过定量数据描述识别的生态源地数量、面积、占比，生态廊道数量、长度等。(2)表述了研究方法具有同时考虑生态系统功能和景观斑块功能的优势，属于结论。(3)得出“综合生态阻力面能够较好地模拟实际生态阻力”的结论，并指出“为高度城市化地区生态网络的构建和优化提供建议”的研究价值。
Paragphy 2 ：① <i>However, how to achieve the optimization of ecological network through specific measures will be intricate but worth studying.</i> ② <i>The interactions between the research area and the surrounding environment should also be emphasized in future studies, and the expansion of scale may lead to ecological networks with new patterns.</i>	段 2 句①指出第一个未来研究展望，即“通过具体措施实现生态网络优化是一个复杂而值得研究的问题”；句②指出了其它未来研究展望，如重视研究区域与周边环境的作用、考虑尺度的影响。

① Wang, S., M. Wu, M. Hu, C. Fan, T. Wang, and B. Xia. 2021. Promoting landscape connectivity of highly urbanized area: An ecological network approach. *Ecological Indicators* 125:107487.

例 3^①：

原文	要点分析
	该文结论是独立一节，包括两段，由研究背景、知识差距、研究方法、研究内容、研究结果、结论以及研究价值 7 个方面构成。
<p>Paraphy 1: ① Danjiang River Basin, as one of the important basins in Qinling Mountains and the water source area of the middle route of South-to-North Water Diversion Project, has strategic significance for China's ecological environment protection and water resources management. ②However, there is a lack of research on the water conservation function of Danjiang River Basin. ③In this study, the InVEST model was adopted to quantitatively evaluate the water yield and water conservation function of the Danjiang River basin in the past 20 years through parameter localization, and the response of water conservation to various factors was analyzed in depth. The results show that:</p>	段 1 句①是研究背景。 句②是知识差距。 句③是研究方法和研究内容。
<p>Paraphy 2: ①The change of water conservation function is the result of the comprehensive effects of climate, soil and land use. ②The south of Shangnan county and Danfeng County, the north of Shanyang County and the north of Shangnan county are the important water conservation areas in the study area, where need our sufficient attention and priority protection. ③The water conservation in the Danjiang River Basin has been declining in the past 20 years, which calls for effective measures to improve the ecological environment quality and strengthen the protection of water resources. ④In addition, the model parameters used in this study can also provide references for relevant studies in basins under similar climatic conditions. ⑤The InVEST model with localized parameters can be applied to other basins with similar climatic and hydrogeological backgrounds but lack of relevant data.</p>	段 2 句①是研究结果，即“研究区水土保持功能的变化是气候、土壤和土地利用综合作用的结果”。 句②~③是结论，分别指出研究区需要给予重视和优化的重要水源涵养区，以及水源涵养呈下降趋势需采取有效措施进行改善和保护。 句④~⑤阐述了研究价值，包括 2 个方面。

通过上述案例分析，可见，一般论文的结论部分主要包括以下方面的内容：

1. 重申研究意义。将研究置于一个广阔背景下，可以直指已有研究中存在的知识差距、难点及关键科学问题，提出研究目标，以及实现研究目标所带来的影响，凸显研究意义。
2. 概述研究方法。对研究采用的方法进行系统性概括，突出是什么方法？作用是什么？用以解决什么问题？通常这里不赘述原理、过程等内容（但也有例外，如方法创新的研究）。
3. 凝练研究结果。在众多研究结果中甄别关键信息，对重要内容进行总结凝练，可采用具体数据支撑，也可以挖掘数据背后的含义，进行适当推论与延伸。
4. 总结研究结论。围绕关键研究结果或推论得出关键性论点、研究主张及新发现与新认识，包括提出相关政策性建议。

① Li, M., D. Liang, J. Xia, J. Song, D. Cheng, J. Wu, Y. Cao, H. Sun, and Q. Li. 2021. Evaluation of water conservation function of Danjiang River Basin in Qinling Mountains, China based on InVEST model. Journal of Environmental Management 286:112212.

5. 点出研究价值：阐述研究的理论价值、实践价值，或通过前瞻性判断表明研究适用范围，及启示性意义。研究价值可从研究的科学问题、研究方法、研究结果/结论等视角展开。

6. 展望研究方向。这部分内容通常出现在讨论部分，主要是勾勒未来研究思路，点明努力方向。

下面再举两则案例，对以上总结进行内容巩固和进一步验证：

例 4^①：

原文	要点分析
<i><u>This study examined</u> the within-city spatiotemporal heterogeneity of air temperature, using Shenzhen City as a case study. <u>We aim to address the following three research questions</u>: (1) How does air temperature vary in space within a city? (2) How does this spatial pattern vary by season, and within a day? (3) What are the quantitative relationships between LST and air temperature, spatially and temporally?</i>	This study examined 表明了研究目的；aim to address, three research questions 提出了聚焦的三个研究问题，目标导向明晰，呼应了引言及方法设计。
<i><u>We found that</u> air temperature varies greatly in space within a city, showing very strong spatial heterogeneity. Additionally, such spatial heterogeneity also varies within a day, and by season. <u>These findings can provide</u> important insights on better understanding the spatial heterogeneity of air temperature within a city, and thereby on urban planning and design for local scale, place-based urban heat mitigation. <u>We found that</u> the spatial and temporal variation in air temperature became more prominent on an extremely hot day, indicating that global warming may exacerbate the difference in air temperature at the local scale. <u>Our results suggested</u> that on a very hot day, locations in cities with relatively high temperatures may suffer more intensive, and longer excessive urban heat.</i>	We found that、These findings can provide、We found that、Our results suggested 这些句式 and 词语清晰的表明了研究结果和总结，并在此基础上得出了研究结论。
<i>By explicitly describing the quantitative relationships between LST and air temperature, <u>this research expands</u> our understanding of the possibility to study air temperature based on LST. <u>These results have important</u> theoretical and management <u>implications</u>. Urban planners and managers attempting to mitigate the impact of urban development on UHI <u>can gain insights into</u> the importance of optimizing the local urban factors.</i>	同理, this research expands、These results have important… implications、can gain insights into 引出了研究贡献和研究价值。

例 4 的结论部分是独立的一段。由于其研究重点并非在研究方法上的创新，所以读者可以看到，结论部分对于研究方法的阐述是进行了简略处理。这种做法虽然在结构上看，是不完整的，但是从逻辑出发，却也是合理的，因为这样使得结论显得更加精炼。此外，结论部分中也没有看到对未来研究进行的展望，是不是也遗漏了呢？不是的，因为在讨论部分中已有了相关的描述，并且构成了讨论部分的一个重要内容。出于与研究方法相同处理的考虑，在结论中也略去了。从这一点看，读者是否看到，写作方法中的灵活多变。还是老话，多看，多积累，多练习，才能熟练掌握。

^① Cao, J., W. Zhou, Z. Zheng, T. Ren, and W. Wang. 2021. Within-city spatial and temporal heterogeneity of air temperature and its relationship with land surface temperature. *Landscape and Urban Planning* 206:103979.

例 5^①

原文	要点分析
<p>Paragraph 1: By <u>applying an integrated framework</u>, this paper <u>characterized the land use conflicts that are expected to occur due to urbanization strategies in the urban-rural interface of Beijing - Tianjin - Hebei</u>. There are <u>three types of conflicts</u>, i. e., conflicts over land use structure, conflicts over land conversion and conflicts over landscape pattern. According to the interactions and relationships among these conflicts, we <u>defined four categories</u> of land use conflict areas. <u>Above all, these conflicts are related to</u> the unplanned use of agricultural land reserves that competes with other more immediate uses, such as the building of houses or various types of industrial activities, and the over-exploitation of land resources caused by unsustainable urban practices.</p>	通过采用 <i>applying an integrated framework</i> 简练地阐述了研究方法。随后,进一步解释研究方法,其中通过 <i>three types of conflicts</i> 、 <i>defined four categories</i> 、 <i>these conflicts are related to</i> 等实现了对现象与原因的解释说明。
<p>Paragraph 2: Perhaps <u>the most interesting result from this study is</u> to assess the feasibility of BRI project for reconciling land use conflicts: after comparing the degree of conflicts between 2010 and 2016, <u>we can suppose that this policy is clearly a critical objective for optimizing the land use structure</u>. <u>It should not</u>, however, be seen as <u>a successful resolution</u> for addressing land use conflicts, because of the considerable agricultural land conversion to non-agricultural uses and the low-density development pattern with mixed residential and industrial land uses. <u>Therefore, alternative strategies</u> (including public participation, spatial equity, rural revitalization, land-use system reform, and new type of urbanization) <u>can be identified</u> as viable solutions for land use conflict management, <u>which may be complementary to regional integration and provide a sound basis and reference on land use and urban planning reference for decision-makers</u>.</p>	通过采用 <i>the most interesting result</i> 重点指出最重要的研究结果。通过 <i>we can suppose that</i> 、 <i>not a successful resolution</i> 、 <i>can be identified</i> 、 <i>which may be</i> 、 <i>provide</i> 一步步给出重点关注的假设、政策目标、决策方案以及原因解释,完成了总结研究结论、升华研究意义的目的。

例 5 是一篇 SSCI 论文的结论部分,由两段话组成。尽管例 5 结论部分写作与前述特征吻合度不是很高,但是选择该文作为案例,其目的就是想表达,我们总结的方法无法涵盖所有可能的写作类型与风格。尽管如此,根据要点分析,仍然可以得知,SSCI 与 SCI 论文在结论部分的写作其实是殊途同归的。两者在包含的内容组成上具有很多相似性。而结论部分的写作,其侧重点都与研究内容直接相关,因此表现出不同的特色,如或者结论的表述更侧重解释说明;或者表述更加强调客观事实,等等。

这里,我们想强调一下,本节关于结论部分写作总结出的六大方面基本内容,具有较广的普适性,对于初学者而言,掌握了最基本的写作方法和技巧,能够为大家提供切实的实践指导,便是很好的完成了我们设定的初衷。

换一个视角来说,即便是 SCI 论文,也会出现并非所有研究的结论部分都需要涵盖总结出的六个方面的内容。由于不同论文的创新和主题等不同,结论写作围绕的侧重点也不同。例如,提出了某个新的方法,那么结论部分,可能侧重描写研究如何使用了这一方法,由此得到了什么样的结果,证明了方法的有效性或先进性。再如,通过研究发现了某个重大结果,那么采

① Ma, W., G. Jiang, Y. Chen, Y. Qu, T. Zhou, and W. Li. 2020. How feasible is regional integration for reconciling land use conflicts across the urban-rural interface? Evidence from Beijing-Tianjin-Hebei metropolitan region in China. *Land Use Policy* 92:104433.

用了什么方法可以简略甚至不必提及。

以下是一篇侧重方法创新的研究论文的结论部分：

例 6^①：

原文	要点分析
	结论的写作中心始终围绕主要创新点展开的,即研究方法的创新,因而在详细阐述的同时,一定程度上弱化了其它内容。
<p>Paragraph 1 ① This research has presented a rule-mining framework based on a land expansion analysis strategy (LEAS), which can bring new scientific understanding of LULC to a study region. ② The LEAS simplified the analysis of land use change while maintaining the ability to support multi-type, complex land use change. ③ Based on the growth probabilities output by the LEAS, a CA model based on multi-type random patch seeds (CARS) was proposed, to better simulate the patch growth of multiple land use types at a fine-scale resolution. ④ As a result, a more realistic landscape pattern can be generated to support decision-making.</p>	段 1 中的四句话,都在重申研究意义。其中,句①表明研究目的,即提出一种方法/框架,句②~④则在阐述这一方法的功能、作用及优势。
<p>Paragraph 2 ① By applying a combination of the LEAS and CARS, we constructed a patch-generating land use simulation (PLUS) model that was available to simulate the change of land use patches and to analyze the underlying drivers of land use dynamics. ② The PLUS model was calibrated using a simulation of Wuhan (2003—2013) and obtained higher simulation accuracy and more similar landscape patterns than the other models tested. ③ The variable importance derived from the LEAS revealed some transition effects that could not be found by the previous analysis methods. ④ For example, grassland was most likely to grow in areas where it was not strongly impacted by human activities, and new deciduous forests were most likely to grow along arterial roads in the suburbs.</p>	段 2 中,句①~②概述研究方法,即方法的构成和应用。句②~④在凝练研究结果,呈现支撑关键性结论。
<p>Paragraph 3 ① By coupling the PLUS model with the MOP, the land use structures under the different scenarios in 2035 and their corresponding future economic and ecological benefits can be predicted, which are of great importance for policymakers to plan for the future development goals of the study region. ② In particular, the land use structure under the SD scenario can be regarded as a baseline for examining whether the study region has developed along a sustainable pathway. ③ In summary, the PLUS model produced results that were more accurate, had more reliable landscape patterns and allowed for important insights concerning the drivers of land expansion. ④ It also can produce substantive guidance for policymakers on how to manage future land use patterns with different development objectives. ⑤ We encourage others to use this approach for understanding the mechanisms of land expansion and to obtain optimal land use patterns under different policies.</p>	段 3 整段都在围绕所提出方法的应用价值与前景,包含了总结研究结论、升华研究价值、展望未来研究。

以上说明,不同论文的结论写作存在差异。初学者在初始阶段无需掌握全部类型的写作方法。其实,通过以上案例分析,已经能够帮助读者较好地较为全面地了解结论部分的写作基

① Liang, X., Q. F. Guan, K. C. Clarke, S. S. Liu, B. Y. Wang, and Y. Yao. 2021. Understanding the drivers of sustainable land expansion using a patch-generating land use simulation (PLUS) model: A case study in Wuhan, China. Computers Environment and Urban Systems 85:14.

本内容了。大家在掌握好基本写作内容以后,可以在后续文献阅读过程中,做到有的放矢,通过比较不同写作格式的案例,就会更好地实现触类旁通。

对于“独立结论(Conclusion)”写作类型而言,其结论部分可以有大致以下写作情景:

- (1)全面性结论,如例 1 和例 2。
- (2)结果性结论。主要特征是,论文结果多且重要、无法进行比较,在结论写作中的篇幅占比较高。
- (3)应用性结论。多见于案例研究中,强调研究实践应用性强。
- (4)启发性结论。旨在突出研究的理论价值,侧重阐释说明科学原理、或关注指导建议等。

三、其它结论类型分析

上述总结的“独立结论”部分写作主要内容,是否适用于其它写作类型呢? 答案是适用的。下面,将继续通过具体案例分析,对“讨论与结论(Discussion and Conclusion)”等其它写作类型,进行深入剖析,解构其结论部分写作内容的组成,以及相关注意事项。希望能够帮助初学者从不同视角,对结论部分的写作要点有一些更加深入的了解,在实践中能够更加灵活地应对不同期刊论文的写作格式与风格要求。

1. 讨论与结论(Discussion and Conclusion)

例 7^①:

结构	部分原文	要点分析
4. 1. Environmental covariates	<i>Rural and urban models were driven by different environmental covariates, which confirms the first hypothesis. As expected, soil variables, such as texture class and drainage class, were of high importance to explain the distribution of native trees in rural areas. ... Future developments of species distribution models in urban areas need to include covariates that address the variety of anthropogenic influence.</i>	存在明显关于凝练研究结果(were of high importance to)、展望研究方向(Future developments)的表述,可以认为是结论写作的内容。
4. 2. Stacking methods	<i>... In this study, however, we worked at a spatial resolution of 1 km×1 km and biotic interactions are less important at this relatively coarse resolution(Thuiller, Pollock, Gueguen, & Münkemüller, 2015). ... and therefore biotic interactions are less likely to drive species composition. As a result, binary stacking seems to be the preferred method for biodiversity modelling at 1 km×1 km resolution in both urban areas and rural areas. ...</i>	存在明显关于凝练研究结果(are less important、are less likely)、总结研究结论(As a result ... to be the preferred method)的表述,可以认为是结论写作的内容。

① Nieuwenhuysen, J.-M. Aerts, J. Van Orshoven, and B. Somers. 2020. An evaluation of species distribution models to estimate tree diversity at genus level in a heterogeneous urban-rural landscape. Landscape and Urban Planning 198: 103770.

续表

结构	部分原文	要点分析
4. 3. Comparison of model outcomes	<i>To conclude , we find that binary stacking is most suitable for both urban and rural areas in Flanders. Stratification of the study area did not improve model quality considerably, but confirmed that different environmental covariates contributed to the models of urban and rural areas. Probability stacking is to be considered in natural areas , but does not perform well in urbanized areas , especially at the spatial resolution of 1 km×1 km.</i>	存在明显关于 总结研究结论 (To conclude, we find、did not improve、but confirmed、probability stacking is)的表述,可以认为是结论写作的内容。
4. 4. Limitations	...	无相关表述。
4. 5. Applications	<i>The models resulting from this study can be expanded by stacking more binary SDMs , by producing species-level models or by producing models of other plant groups. Spatially-explicit biodiversity data are vital for emerging environmental health studies (McInnes et al. , 2017) , Hjort et al. (2016) present a concept to calculate individual long-term or life time exposure to pollen with geographic information systems. Landscape and urban planners could also use tree diversity maps to identify areas with low diversity and optimize the delivery of ecosystem services or decrease potential social inequalities in access to biodiverse green space by increasing biodiversity in focus areas (Wolch , Byrne, & Newell , 2014). ...</i>	存在明显关于 升华研究价值 (The models resulting、are vital for、Landscape and urban planners could also use...to identify...and optimize)的描述,可以认为是结论写作的主要内容。

例 8^①:

部分原文	要点分析
<p>Paragraph 1: ... , this study modified value coefficients and re-measured biomass factor adjustment coefficients and social-economic factor adjustment coefficients , to examine the change in ecosystem services at the regional scale , and to reflect the effect of land use change on ecosystem services value as well , from the period of 2000 to 2018. The major conclusions are summarized herein , and put forward targeted policy recommendations accordingly.</p> <p>It is very important to raise awareness of ecosystem services to society , and aid policy-makers to formulate different policy-making strategies for it. ...</p> <p>The land use structure of Fujian province has presented significant evolution. This study found that However, the extensive development mode is the main reason for the significant differences in urbanization levels between the various regions of Fujian province. Therefore, we suggest that the government should further optimize the allocation of land resources , and properly limit the expansion speed of urban construction land. ... Additionally, it is necessary to further optimize the urban spatial structure</p> <p>Land use change is the main driving force for the spatial pattern of ecosystem services and overall supply changes. This study results revealed that ...</p>	<p>重申研究意义:概述了研究方法与研究目的,即修正了 this study modified、重新测量了 re-measured、考察了 to examine、反映了 to reflect。最后一句话,承上启下,引出后文主要结论与政策建议。</p> <p>总结研究结论:阐述了提升...认识 raise awareness,帮助...制定 aid to formulate,重要意义 very important 的观点。</p> <p>提出对策建议:首先是明显特征 presented significant,据此提出 this study found,给出建议 suggesst,进一步 should further,适度限制 properly limit。此外,需要进一步 necessary to further。</p> <p>总结研究结论:给出主要驱动力 main driving forces 的结论,然后给出推断 results revealed。</p>

① Su, K. , D.-z. Wei, and W.-x. Lin. 2020. Evaluation of ecosystem services value and its implications for policy making in China-A case study of Fujian province. Ecological Indicators 108:105752.

续表

部分原文	要点分析
<p>Paragraph 2: From the primary classification of ecosystem services, the regulatory service is the most important function in ecosystem services in Fujian province. ...</p>	<p>总结研究结论: 得出最重要的功能 most important function, 并为关键性结果做支撑。</p>
<p>Paragraph 3: It is noteworthy that in recent years, Fujian province has been accelerating the implementation of afforestation policy. ... Hence, under the premise of limited resources, it is necessary to further improve resource utilization to resolve the contradictions between resource shortage and social-economic development through the establishment and implementation of rational ecological supplement system.</p>	<p>总结研究结论: 给出显著 noteworthy 加快 accelerating 的观点。提出对策建议: 提出有必要 necessary 进一步 to further 的建议。</p>
<p>Paragraph 4: In summary, the land area of Fujian province is mostly mountainous and hilly, with limited land resources and large population. Optimizing the allocation of land resources has become the key to promoting regional sustainable development and ecological civilization construction. This study reveals to some extent the land use change and its ecosystem response in Fujian province, which can provide appropriate information and decision support for the formulation of corresponding management policies. Also, it is of great theoretical significance for enriching the ecosystem management theories, as well as making up for the insufficient research on the system for assessing regional ecosystem services value. However, due to the complexity of interaction mechanism and internal evolution mode between urbanization process and ecological environment; if we can define the scope and degree of the impact of urban construction land on the ecosystem, it will have a positive role to play in further clarifying the spatial-temporal evolution law of regional urbanization development and improving the quality of regional urbanization, as well as have more practical guidance for regional development. Therefore, with the further development of spatial measurement methodology and spatial analysis software, we will continue to explore in depth, which is expected to provide important ideas for the follow-up research work.</p>	<p>以 in summary 起始, 意味明显, 完整性结论开始。其中, 重申研究对象特征 mostly、with limited...large 和研究背景 the key to promoting。总结研究 study reveals 点题, 强调知识差距 can provide, 以及理论价值 great theoretical significance 和 making up 的重要意义。通过转折 However, 指出研究局限性 due to 和研究努力方向 if ...define 及其积极意义 it will。全面总结研究及后续工作 with the further...will continue。</p>

通过例 7、例 8 的两个“讨论与结论”写作类型案例, 可以看到, 其结构大致分为两类:

(1) 小节式结论与讨论。当整节分为几个部分时, 结论的主要内容可以是其中的一个小节, 其它分散的内容可以根据结论写作的内容特征进行相应拆分。

(2) 分段式结论与讨论。当整节为连续的段落时, 结论的主要内容可以根据各自内在逻辑进行拆分, 如围绕几个关键性论点进行分段论述, 然后再采用总结性段落进行概述。

从写作内容角度看, 无论是采用何种组织形式, 写好“结论与讨论”类型的关键是, 通过合理、有序地组织, 实现论文讨论内容与结论内容的有机融合, 使得两者在内容关系和逻辑关系上承接连贯。实践中, 初学者可以尝试采用以下两条建议:

(1)对重点部分进行完整总结。如采用“in conclusion”、“based on the above discussion, we can concluded that”等表述作为起始,每一段围绕一个关键性论点进行阐述。如果采用单独的一节来进行概括,可以通过设置如“4.1 Main achievements”,“5.3 Applications and implications”等 sub-headlines 子标题,分别突显各小节的内容,如凝练研究结果、升华研究价值、展望未来研究等。

(2)使用明显的、具有标志性的词/词组/句型等进行强调。如采用“Our results show that”、“These findings lead to the conclusion that”、“These results clearly demonstrate that”、“This study reveals that 等,以强调研究结果及其意义,采用“the model can expand/benefit”等总结研究结论、升华研究价值等。

2. 结果与结论(Results and Conclusions)

一般而言,这种写作类型出现的情况较少,与“讨论与结论(Discussion and Conclusion)”的写作风格具有明显相似性。在此,提供一篇采取这种写作类型的论文,可以供初学者查阅学习。

Wu, J. J., X. Wang, B. Zhong, A. X. Yang, K. S. Jue, J. H. Wu, L. Zhang, W. J. Xu, S. L. Wu, N. Zhang, and Q. H. Liu. 2020. *Ecological environment assessment for Greater Mekong Subregion based on Pressure-State-Response framework by remote sensing*. *Ecological Indicators* 117: 14. 10.1016/j.ecolind.2020.106521

第三节 思考与练习

一、课后思考

结论部分是整篇论文的精华所在。它并不是简单的重复之前各节中已阐述过的研究内容,而是需要针对引言中所提出的科学问题、研究目标,以及结果,提炼归纳出系统的观点和认识,让读者能够快速了解论文的主要观点和贡献之所在。

为了能够更好地了解到读者对本讲内容掌握的熟练程度,读者们可以尝试完成以下练习:

(1)以下哪些句子适合在结论部分出现呢? 如果适合出现,请问应该构成结论部分中的哪一部分内容? 如果不适合出现,请阐述原因。

1. *One important contribution of our study is the development and assessment of metrics based on genetic diversity that governments in the Alpine convention can use to improve their protected area network.*

2. *In previous studies of Green Infrastructure Networks, i. e., GINs, optimization, most studies have focused on the optimization of ecological patches and ecological corridors, however, as another important factor affecting the stability of GINs, few studies have considered the impact of disturbance sources on GIN optimization.*

3. *By analyzing the robustness of SSNs under different policy scenarios,*

this study provided a new perspective for exploring how to maintain high-quality connections between habitats, which gives guidance toward the mitigation of regional habitat isolation.

(2) 根据本讲内容,请从是否符合写作要求、写作类型及内容组成等方面,全面剖析以下一则案例^①:

Stakeholders use and value marine environments within an MPA in many different ways. In this study, it was found that the central driver for many stakeholders in interacting with these environments is accessing and enjoying marine species in extractive and non-extractive ways. Using a process of participatory sketch-mapping provides a method that can be used to identify hotspot locations that stakeholders' regularly use to access these species, known areas that support species persistence, and identify areas of ecological threats. Combining this information with scientific studies using GIS fuzzy-set spatial modelling approaches, provides a technique to develop species distributions models that identify gaps in spatial understanding and highlights areas that need targeted management. Developing this level of strategic spatial understanding across MPAs provides a way to develop readily accessible outputs that can be used by both decision-makers and stakeholders to understand, discuss, and adapt marine spatial management approaches that support both social and ecological priorities.

二、课后练习

结论部分是一篇 full text 论文的最后部分。按照写作进度安排来看,初学者们也已经到了完成该部分写作的时候了。

首先,请大家检查一下,自己的写作进度是否达到了预设要求。如果没有,则需要加快速度。要知道,一篇论文的第一稿的写作,最好是一气呵成,不要拖拖拉拉。即便是写的不好,也没有关系,后续可以一点点修改完善。

其次,如果读者们已经与本讲时间安排同步,完成了写作初稿。很好,请依次完成以下 4 项内容的练习。如果前一项练习已经完成,可以跳至下一项练习。如果前一项练习没有完成,建议暂不要跳至下一项,因为这种跳跃,练习的效果会大打折扣。我们设置练习的目的,是为了提升初学者们论文写作的能力,而不是为了练习而练习。

(1) 请尝试使用本讲中提到的基本内容作为标准,完成自我检查。看看各要素是否完整? 如果不完整,请考虑遗漏了哪些? 是否需要补充? 如果不需要补充,请列出原因。

(2) 当完成自我检查以后,请学长或好友(最好是与论文内容具有相同研究背景的人)看看,提一些意见。请注意,这个环节关注的侧重点,不再是核验结论组成部分的完整性了,而是

^① Noble, M. M., D. Harasti, C. J. Fulton, and B. Doran. Identifying spatial conservation priorities using Traditional and Local Ecological Knowledge of iconic marine species and ecosystem threats. *Biological Conservation*. 2020, 249: 108709.

侧重于检查其内容。

他人的阅读,就是去发现,你所写的结论是否在自成体系的基础上,能够把研究的核心内容清晰地表达出来。如果他/她们存有疑问,请注意,一定要细心听,把问题全部记录下来,切记不要急于解释。之后,依据这些疑问,尝试对结论部分进行修改。这次修改的重点是,不是形式了,而是内容了。

修改完之后,再去请之前帮自己审阅的朋友看看,征询他/她们,提出的疑问,是否在修改稿中已经解决了。如果已经完全解决了,很好。再去找另外一个人,帮自己看看。如果没有解决,请他/她们指出来,具体是什么?

如果可能的话,请反复这一环节的练习,两至三次,即可,不必过多。

(3)无论修改的如何,问题是否得到完全解决,请拿着几个版本,向自己导师请教。重点问题包括:哪一个版本写的好? 学长/同学提出的问题中有哪些,自己在修改稿中无法修改到位,请问如何解决。然后,按照导师的建议,重新修改。

(4)当完成以上 3 个环节练习以后,请自己反思一下,自己有哪些所得,有哪些地方还比较薄弱,需要加强。请牢记,“学而不思则罔,思而不学则殆”的重要性。

当然,以上四个环节的练习,也适合其余各讲。