

**Project Title:** NPLCC Guide to Planning Tools (Funding Announcement #2, Action 2.3)

**Principal Investigators:** Patrick Crist, Director of Conservation Planning and Ecosystem Management, NatureServe, [patrick\\_crist@natureserve.org](mailto:patrick_crist@natureserve.org), 703-797-4810; Sarah Carr, Coastal-Marine Ecosystem-Based Management Tools Program Manager, NatureServe, [sarah\\_carr@natureserve.org](mailto:sarah_carr@natureserve.org), 703-908-1892

**Project Summary/Project Proposal:** This project will create a targeted and easily understandable guide to tools that support landscape-level planning in the face of climate change for NPLCC partners. The guide will build on previous NPLCC research on decision support needs with an emphasis on tools currently in use in the region. A survey of NPLCC partners will discover who is currently using or planning to use tools in the region, tools they are using, how well these tools are meeting their needs, and regional and outside experts engaged in tool use. Additional tools research will provide information on tools not currently in use in the region that could also provide needed functionality.

**Objective and Need:** The objectives of this project are to:

- Understand the tool needs of NPLCC partners by reviewing previous surveys and engaging LCC partners directly through webinars and a targeted survey
- Understand tools and approaches for landscape-level planning currently being used by LCC partners and how successfully these tools and approaches are meeting partner needs
- Conduct tools research to discover if there are any existing tools not currently in use in the region that could help address expressed landscape-level planning needs
- Create a targeted and easily understandable guide to a set of key tools that meet NPLCC partner needs including case studies of current tool use in the region and regional/outside experts/users of these tools
- Share toolset information with NPLCC partners and the broader conservation-natural resource management community through a published tool guide and a webinar for NPLCC members.

This project would help the NPLCC achieve a number of its goals. It would help maximize the ability of partners to make informed decisions for conservation and resource management subject to climate change by connecting practitioners to relevant tools. It would promote information and resource sharing throughout the LCC by connecting NPLCC partners with others in the LCC with similar needs who are considering, planning, or conducting relevant work using tools. It would also promote awareness of NPLCC work for landscape-level conservation in the face of climate change by broadly disseminating a tool guide featuring case studies of NPLCC work to the U.S. and international conservation and natural resource management community.

A recent assessment of the climate change-related challenges, needs, and opportunities of the NPLCC (Tillman and Siemann 2012) found that two major challenges for NPLCC partners are “identifying, understanding, and using climate change science, data, tools, and/or information” and “coordinating, collaborating, and communicating among the people, projects, and institutions” of the NPLCC (Tillman and Siemann 2012). In addition, this survey found identifying appropriate tools to be a key management need throughout the LCC. This project would help address these challenges and needs by creating a targeted, easily understandable guide to tools that address NPLCC partner needs so that partners can more easily find and use tools to incorporate the best available information into their decision making. This project would also help NPLCC partners with similar needs and activities find each other to increase communication and collaboration.

This work would be conducted by NatureServe, a nonprofit conservation organization dedicated to providing the scientific basis for effective conservation action. NatureServe has extensive experience conducting tool surveys and research and creating technical guides on tools including the Integrated Land-Sea Planning toolkit and technical guide for the Mission-Aransas NERR (Crist et al. 2010), the Refuge Vulnerability Assessment and Alternatives framework for the U.S. Fish and Wildlife Service (Crist et al. 2012), the Integrated Ecological Framework for the Transportation Research Board (Achterman et al. 2010), and guides for the Application of the Yale Mapping Framework for Climate Change for the Bureau of Land Management (Crist et al. In Press). In particular, this work would take advantage of the Coastal-Marine Ecosystem-Based Management Tools Network (EBM Tools Network) coordinated by NatureServe. The EBM Tools Network is an alliance of over

5,100 conservationists, resource managers, and tool experts that connects practitioners with tools that help incorporate science and stakeholder input into decision making. The EBM Tools Network conducts a wide variety of research and outreach on tools for conservation and management including: 1) hosting a very popular semi-monthly webinar series on tools and tool use case studies (50-400 participants per webinar, over 3,200 participants in the past 12 months), 2) moderating the EBM Tools Network listserv (over 3,800 participants) which engages in discussions of available and appropriate tools for conservation and natural resource management, and 3) providing an online database of tools that is the only comprehensive web-based source of information about EBM tools. In 2012, we conducted an analysis to formulate a toolkit for the Humboldt Bay region of northern California and demonstrated how to apply tools to integrated landscape planning and climate change adaptation. This year, the Network leveraged its knowledge of the tools field and coastal planning and management needs and close connections with climate change experts and tool developers to develop a guide to tools for coastal climate adaptation planning *Tools for Coastal Climate Adaptation Planning: A Guide for Selecting Tools to Assist with Ecosystem-Based Climate Planning* (EBM Tools Network 2013). The guide, released in March, addresses the critical need of coastal natural resource managers and community planners for a thorough and approachable guide to tools for climate change vulnerability assessment and adaptation planning. The guide was downloaded by over 1,000 practitioners within the first 24 hours of release.

This project will be led Drs. Patrick Crist and Sarah Carr from NatureServe. Dr. Crist is the Principal Investigator of the EBM Tools Network and has been involved in tool research and development for over 15 years. He has led development of numerous technical guides on tools (e.g. Crist et al. 2010, 2012, 2013, In press). Dr. Carr has coordinated the EBM Tools Network since 2006 and has extensive experience developing and providing usable information to natural resource management and conservation practitioners. She has conducted numerous national surveys about tools and best practices (see attached CV) and was an author of the Network's recent coastal adaptation planning tool guide (EBM Tools Network 2013). This work will leverage NatureServe's (including the EBM Tools Network's) existing knowledge of the decision support tool field, understanding of practitioner needs/limitations for tool use, experience with evaluating the applicability of tools, relationships with tool providers, expertise creating climate change tool guidance, and relationships with practitioners and tool providers and experts throughout the NPLCC region including in British Columbia.

For this work, we will use a broad definition of tools. Our research will consider tools that facilitate: 1) gathering and distributing relevant data (e.g. regional databases that support queries and downloads), 2) conducting analyses and modeling (e.g. vulnerability assessments), 3) visualizing data and analysis/modeling results (including current and potential future conditions), and 4) integrating information into planning for conservation, land use, and land management.

**Methods:** To achieve our objectives, we will:

- 1) **Develop preliminary information on potentially relevant tools** to support landscape-level planning in the face of climate change. To develop this information, we will utilize results from the 2011-2012 assessment of climate change-related needs for the NPLCC (Tillmann and Siemann 2012). This assessment captured considerable input from NPLCC partners on their climate change-related tool needs (e.g. tools and approaches for conducting vulnerability assessments, identifying the current and potential future distribution of intertidal habitats and species, and assessing management options for focal species) as well as tools that partners are currently using. We will augment this tools information with information on other tools highly-relevant to the tool needs expressed by NPLCC partners using sources of tool information such as *Tools for Coastal Climate Adaptation Planning* (EBM Tools Network 2013), *Scanning the Conservation Horizon: A Guide to Climate Change Vulnerability Assessment* (Glick et al. 2011), *Adapting to Climate Change: A Planning Guide for State Coastal Managers* (NOAA 2010), *Manager's Guide to Refuge Vulnerability Assessment and Alternatives: Overview and Practical Considerations* (Crist et al. 2012), a compendium on methods and tools to evaluate impacts of, and vulnerability and adaptation to, climate change (UNFCCC 2008), NOAA's Digital Coast ([www.csc.noaa.gov/digitalcoast](http://www.csc.noaa.gov/digitalcoast)), EcoAdapt's Climate Adaptation Knowledge Exchange ([www.cakex.org](http://www.cakex.org)), and the EBM Tools Network's tools database ([www.ebmtoolsdatabase.org](http://www.ebmtoolsdatabase.org)).
- 2) **Engage NPLCC partners in the planned research.** We will engage NPLCC at the start of this project by hosting a group webinar to:

- a. Present the planned research process and intended products and solicit input on potential process and product improvements including the desired role for traditional ecological knowledge (TEK) in tools
  - b. Present the preliminary toolset (created in Step 1 above) and resources/capacity needed to use tools and solicit additional input from participants on key tool needs not addressed and availability of resources/capacity for using existing tools. This information will be used to focus further tools research.
- 3) **Survey NPLCC partners about tools and approaches they are currently using or considering for climate change-related decision making.** The survey would elicit tools and approaches NPLCC partners are currently using or considering for landscape-level planning, how well current applications are meeting partner needs, partners for current and proposed work (for establishing a roster of experts), and key science and planning needs not currently served by tools or approaches (to supplement the Tillman and Siemann (2012) findings). We will use SurveyMonkey to conduct the survey and will make the survey as short and easy as possible to maximize participation. We will, as needed, conduct targeted phone interviews with tool users and experts in the NPLCC and with Tribal and First Nations representatives to understand TEK-related tool needs and applications. NPLCC staff and select NPLCC partners will be asked to review a draft of the survey to ensure that survey questions elicit the information needed.
  - 4) **Analyze survey results** to:
    - c. Determine the full range of tools currently being used or considered for climate change-related decision making, how these tools are being used, where they are being used, and how well they are working for the desired purposes
    - d. Identify geographic areas not using tools but with similar application needs that might benefit from use of tools being used elsewhere in the NPLCC
    - e. Identify potential partners (practitioners currently using tools, tool experts, practitioners interested in initiating tool use) for a Community (or Communities) of Practice for tool use.
  - 5) **Research additional tools to meet unmet science needs** identified by the Tillman and Siemann (2012) survey and supplemented with results from the survey described above (Steps 3 and 4). This research will use existing tool guides and databases (see examples in Step 1 above) as well as take advantage of the EBM Tools Network's interactive listserv (>3,800 participants) to identify tools and approaches to address specialized needs. In addition, we will also utilize extensive contacts in the NPLCC region (e.g. Ecotrust, Pacific Marine Analysis and Research Association, University of British Columbia, EcoAdapt, Dr. Jennie Hoffman, Conservation Biology Institute) to discuss tools currently being used in the region and other tools suitable for addressing priority needs in the region.
  - 6) **Engage NPLCC GIS committee to provide input on a potential set of priority tools** for the NPLCC. We will present the survey and tools research results to NPLCC GIS committee members via webinar to solicit their input on tools that would best address the needs of and be usable by NPLCC partners.
  - 7) **Select toolset of priority tools to present to NPLCC partners.** In selecting a final toolset, we will pay close attention to the resources and capacity needed to use the tools and will limit the number of tools in the toolset. Our extensive experience coordinating the EBM Tools Network and facilitating tool use has taught us that: 1) for tools to be utilized, it is imperative that they fit the available capacity and resources (including data availability) of target audiences and 2) when presenting tool information to potentially interested practitioners, it is more effective to present detailed information on a limited number of highly relevant tools rather than extremely basic information on a wide swath of tools. The full results of our tools research will be available to NPLCC partners, however, if they wish to learn about a broader array of tools.
  - 8) **Interview ~5 tool users about tool use and create case studies describing tool use.** We will select case studies based on type of tool used (with a preference for case studies featuring use of tools in the priority toolset) and likely applicability to other areas in the LCC and will interview key implementers about the tool use. We will aim to include at least one TEK-relevant case study. Case study write-ups will follow the format of the Case Studies section (pgs. 32-41) of the *Tools for Coastal Climate Adaptation Planning* document (EBM Tools Network 2013) with the addition of a section for Helpful Hints and Lessons Learned.
  - 9) **Create written guide to NPLCC toolset** consisting of:

- a. An explanation of the role for tools in the NPLCC and brief summary of tool use to date
  - b. Descriptions of each of the tools and the regional needs that they address
  - c. Links to representatives from projects and processes that have used the tools and can provide first-hand information on experiences using the tools
  - d. Links to experts who can provide support for using the tools
  - e. A tool matrix that provides easily comparable information about the tools including data requirements, key outputs, appropriate scales, computer and software requirements, training requirements, cost, and available resources (e.g. documentation, training, user groups). This matrix will be similar to the Tool Matrix (pgs. 22-25) in *Tools for Coastal Climate Adaptation Planning* (EBM Tools Network 2013)
  - f. Case studies including Helpful Hints and Lessons Learned gathered from the case studies
  - g. Areas for which there are no available/appropriate tools that meet partner needs (“tool gaps”)
  - h. Information on existing demonstration and case study webinars for tools in the NPLCC toolset. The EBM Tools Network has been hosting semi-monthly tool demonstration and case study webinars for more than over six years and has recordings of webinars on many potential tools in the NPLCC toolset.
- 10) **Present tools guide to NPLCC partners** via webinar to help NPLCC partner learn more about specific tools and other NPLCC partner experiences using them.
- 11) **Disseminate guide via NPLCC mailing lists and website as well as the EBM Tools mailing list (over 5,100 members) and database.**

**Geographic Extent:** This work will be conducted for the North Pacific LCC region as a whole (from the Kenai Peninsula in Alaska to Bodega Bay in northwestern California including the west coast of British Columbia), and the information generated will be applicable to the entire NPLCC as well as to other LCCs.

Activities	Time-frame	Products/Outcomes
1) Develop preliminary tool information	Sep13	Set of tools likely applicable to NPLCC needs
2) Engage NPLCC partners via webinar	Oct13	Revised workplan/NPLCC partners will be aware of and have provided input into research
3) Survey NPLCC partners about tools	Nov13	Survey results PPT/ Understanding of current/planned NPLCC tool use and unmet tool needs
4) Analyze survey results	Dec13-Jan14	
5) Research additional tools	Feb14	Expanded set of potential tools including tools that can address unmet NPLCC needs
6) Validate survey analysis and tool results through webinar with GIS committee	Mar14	Understanding of appropriateness of potential tools for NPLCC needs
7) Select NPLCC toolset	Apr14	Priority set of tools addressing NPLCC needs
8) Create case studies of NPLCC tool use	May14-Jun14	Documented case studies/Detailed understanding of current NPLCC tool use
9) Create NPLCC tool guide	Jul14	Tool guide /Targeted, understandable information on tools addressing NPLCC needs available
10) Present tool guide to NPLCC partners	Aug14	Recorded webinar/NPLCC partners aware of available tools and NPLCC members using tools
11) Disseminate guide	Aug14	Broader conservation/management community aware of NPLCC tool use
12) Submit project final report	Aug14	Project final report

**Disclaimer regarding Data Sharing:** We do not expect any restrictions on the data, information, and products generated by this project except in instances when those providing survey information (e.g. TEK shared by First Nations and Tribes) do not wish it to be made public. In these instances, we will work with data and information providers to determine how the data/information can be used (e.g. shared with project partners, used in aggregate reporting, etc.) and use the data/information in a compliant manner.

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## **PATRICK J. CRIST, PH.D**

NatureServe; 703.797.4810; Patrick\_crist@natureserve.org

### **PROFESSIONAL EXPERIENCE**

#### **Director, Conservation Planning & Ecosystem Management Program**

NatureServe, 2001-Present

**Primary responsibilities:** Director of conservation planning & research projects; PI for Packard Foundation Coastal-Marine EBM Tools Program; NatureServe Vista DSS program manager, PI for BLM Rapid Ecoregional Assessment projects. Previously National Program Coordinator and Principal Investigator for the National Gap Analysis Program, USGS, University of Idaho, 1995-2001

#### **USGS Gap Analysis Program**

National Program Coordinator and Principal Investigator (July 1995-Feb 2001)

New Mexico GAP Project Coordinator (January 1993- September 1995)

#### **Senior Landscape Architect**

Landsystems Inc. Redwood City, CA (June 1984-August 1990)

Additional relevant experience:

- Serve on Technical Expert Group for Transportation Research Board on conservation tools
- Served on advisory panel for new guide on scenario-based planning for LCCs
- Served on expert panel for UNEP climate change I&M guide

### **EDUCATION**

**Doctorate of Philosophy of Natural Resources**, University of Idaho, 2003

**Master of Landscape Architecture** University of Pennsylvania, 1993

**Bachelor of Landscape Architecture**, California Polytechnic State University, 1984

### **KEY RECENT PROJECTS**

#### **Pilot Test of the Yale Framework Integrating Climate Change and Conservation**

This project tested the Yale Framework in the ecotone between the Central and Mojave Basins in support of Nevada BLM (and two pilot Field Offices) planning for near and long term (climate adaptation) management. Acted as the Principal Investigator. (completed 2012)

#### **Rapid Ecoregional Assessments (REAs) for the Western U.S.**

The REAs are being conducted systematically throughout the Western U.S. in support of BLM's landscape management. They are intended to guide ecoregional management direction. Act as the Principal Investigator for four REAs. Oversee large team of NatureServe staff and external partners and coordination with BLM and partners. (Ongoing projects)

#### **The Refuge Vulnerability Assessment & Alternatives (RVAA) Framework**

The RVAA integrates climate change with multi-stressor cumulative effects assessment to understand threats to refuge resources and infrastructure over multiple timeframes and guide the generation of mitigation/adaptation strategies and management alternatives. (completed 2012)

### **The Integrated Ecological Framework**

The IEF is a multi-step process to integrate conservation proactively into regional transportation planning. Acted as co-science lead and wrote the key components for developing Regional Ecological Frameworks and Cumulative Effects Assessment and Alternatives steps. The guide contains numerous references to tools at each step (completed 2012).

### **Conservation Assessment and Prioritization for the Coastal Georgia Region**

I was the NatureServe lead working with the GA DNR, county association of GA, and the GA Conservancy to integrate a large amount of ecological data into a decision support toolkit that addressed biodiversity patterns, connectivity modeling, cumulative effects assessment (including sea level rise) and conservation prioritization. The regional project was then stepped down to two pilot county projects (completed 2010)

### **Assessment of Wildlife Suitability of Renewable Energy Zones Throughout the Western U.S.**

This project worked with the Environment and Lands Working Group of the WGA to develop the data and conduct the analyses to assist in assessment and refinement of renewable energy zones under the WGA's Western Renewable Energy Zones initiative. Acted as Principal Investigator: participate in the working group and derive the categorizations and criteria for the analyses, direct technical staff in the analyses, and develop the products (completed 2009)

### **Integrated Land-Sea Planning Approach and Toolkits (2008-9)**

This item consisted of two "tool demonstration projects" of the EBM Tools Network. We worked with NOAA CSC, Placeways, Sea Grant, and University of Texas to develop an integrated planning model, a project database, and a demonstration of the toolkit and process for Aransas County, TX that integrated land use, conservation, and estuary management. A similar partnership lead by PlaceMatters addressed integrated coastal land use and hazard planning coupled with conservation for the Charleston, South Carolina region. I developed proposal concepts, recruited the TX test site and project team, devised the TX integration model, and assisted in the demonstration and guidebook development in both projects (completed 2009).

### **Conservation Planning Support System Software (Vista, 2001-ongoing)**

Project manager focused on the development of the science methodology and translation to software requirements. I coordinated a large science, GIS team, and engineering group to develop, build, and release the tool. First release March 2005, several subsequent releases and ongoing development with over 2000 downloads globally to date.

## **REPORTS AND PUBLICATIONS**

- Crist, P., K.M. Madden, J. Hittle; D. Walker; T. Allen, D. Eslinger. 2013. Supporting Cross-Sector, Cross-Ecosystem Planning through Interoperating Toolkits. *Journal of Conservation Planning*, v 9.
- Crist, P.J. BLM Guide to Climate Change Adaptation: Application of the Yale Mapping Framework. BLM Nevada State Office. 2013.
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## ***Sarah D. Carr, Ph.D.***

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### ***Relevant Experience***

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#### **Coastal-Marine Ecosystem-Based Management Tools Network Coordinator, NatureServe (Arlington, VA, February 2006-Present)**

- Grew Network to over 5,100 coastal and marine conservation and natural resource managers worldwide; members represent federal and state agencies in the US, Australia, and Europe; universities worldwide; all major environmental NGOs; the UN Food and Agricultural Organization; philanthropic foundations; regional NGOs; and for-profit businesses
- Co-authored an accessible and in-depth climate change tool guide *Tools for Coastal Climate Adaptation Planning: A Guide for Selecting Tools to Assist with Ecosystem-Based Climate Planning*. Guide downloaded by over 1,000 practitioners within 24 hours of release
- Lead and coordinate complex events (trainings, meetings, symposia) and develop products (surveys, reports, databases, best practices) which involve voluntary efforts of multi-institutional teams
- Started and coordinate highly successful webinar series seen as model for outreach by other organizations including federal agencies. Hour-long webinars routinely attended by 100-300+ coastal and marine resource managers worldwide
- In 2008, led coordination of highly successful training event in Australia which brought 20 of the world's foremost marine conservation planners together with over 30 conservation practitioners from Pacific nations
- Co-host monthly live on-line chats about key EBM tools (e.g. Ocean Health Index) and with leading conservationists (e.g. Director of Planning, Great Barrier Reef Marine Park Authority)
- Conducted global surveys of coastal and marine resource managers to determine marine spatial planning tools that get used in the field and priority needs for improving coastal-marine conservation and management
- Moderate the EBM Tools Network listserv (over 3,800 participants) which engages in discussions of tools for diverse coastal-marine conservation and management needs
- Write column for Marine Ecosystems and Management (MEAM) newsletter with circulation of over 5,000 coastal and marine managers. Serve on MEAM editorial board
- Provide peer review for ecosystem-based management proposals and manuscripts to foundations, government agencies, and professional journals
- Primary manager of over \$2.6M in grant funding. Secured over \$1.9M in grant funding

#### **NOAA Sea Grant Knauss Marine Policy Fellow, U.S. Environmental Protection Agency Coastal Management Branch (Washington, DC, February 2005-January 2006)**

- Worked with team to coordinate workshop of leading social science and ecology experts from universities and the federal government to develop national estimates of economic impacts of aquatic invasives ([water.epa.gov/type/oceb/habitat/aquatic\\_invasive.cfm](http://water.epa.gov/type/oceb/habitat/aquatic_invasive.cfm))
- Developed educational resources (on-line and print) to assist coastal and marine managers remove invasive species

### ***Training and Affiliations***

- Completed 40+ hours of meeting facilitation and network effectiveness training
- Member of The Coastal Society, Society for Conservation Biology, Society for Conservation GIS, DC Marine Community, Women's Aquatic Network

## ***Education***

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### **University of North Carolina at Chapel Hill**

*Ph.D. in Marine Science*

Chapel Hill and Morehead City, NC, August 2000-August 2006

- Dissertation: *The influence of vertical migratory behaviors on the transport of marine organisms*
- UNC-Chapel Hill Graduate School Royster Fellow (2000-2006); UNC-Chapel Hill Latane Fellow (2000-2001); National Defense Science and Engineering Graduate Fellow (2001-2004)

### **University of Otago**

*Diploma for Graduates in Marine Science*

Dunedin, New Zealand, January-December 1999

- Rotary International Ambassadorial Scholar
- Conducted independent research characterizing environment of small Fiordland marine reserve

### **Amherst College**

*B.A. in Economics, Magna Cum Laude*

Amherst, Massachusetts, September 1993-May 1997

- Williams College-Mystic Seaport Maritime Studies Program, Mystic, CT, Spring 1995
- Scripps in Ecuador Study Abroad Program, Quito, Ecuador, Spring 1996

## ***Select Publications***

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**EBM Tools Network (co-author)** 2013. Tools for Coastal Climate Adaptation Planning: A guide for selecting tools to assist with ecosystem-based climate planning. NatureServe. Arlington, VA.

**Carr, S.D.** 2013. Global Survey of Tools Used for Marine Spatial Planning.

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Curtice, C., Dunn, D. C., Roberts, J.J., **Carr, S. D.** & Halpin, P. N. 2012. Why Ecosystem-Based Management May Fail without Changes to Tool Development and Financing. *BioScience* 62(5), 508–515.

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**EBM Tools Database (lead author)** 2011. EBM Tools Network Database.

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**EBM Tools Network (lead author)** 2009. Outcomes from the Coastal-Marine Ecosystem-Based Management Tools Network Training Program, NatureServe, Arlington, VA.

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